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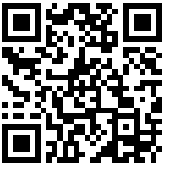

THE

ELECTRIC TELEGRAPH:

WAS IT INVENTED BY

PROFESSOR WHEATSTONE?

BY

WILLIAM FOTHERGILL COOKE, ESQ.

Extract from "Award," page 14.

"Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking."

(Signed) "M^c I^d BRUNEL.
"J. F. DANIELL."

FOURTH EDITION.

Price Sixpence.

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LONDON:
PRINTED FOR THE AUTHOR,
AND SOLD BY
W. H. SMITH AND SON, 136 AND 137, STRAND.
1866.

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In 2 vols., Imperial octavo, Illustrated by numerous Plates.
Price 10*s.*

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WILLIAM FOTHERGILL COOKE, ESQ.

VOL. 1.—PAMPHLETS OF 1854-6.
VOL. 2.—ARBITRATION PAPERS.

LONDON:
SOLD BY W. H. SMITH AND SON, STRAND.
1857.

PRINTED BY THE LONDON PRINTING AND PUBLISHING COMPANY, LIMITED,
26, PATERNOSTER ROW, LONDON, E.C.

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PREFACE TO THE THIRD EDITION.

THIS pamphlet was originally published in 1854, as my appeal to the Public against the injustice of an article in the "Quarterly Review," which is proved, by written evidence in my possession, to have been "prompted exclusively by Professor Wheatstone." By this article, Mr. Wheatstone had sought to appropriate to himself the sole merit of the invention of the Electric Telegraph, although the late Sir Isambard Brunel and Professor Daniell, as arbitrators between us, appointed by deed of reference to "determine conclusively" "in what shares, and with what priorities and relative degrees of merit" we were "co-inventors of the Electric Telegraph," had, by their award (accepted and confirmed in writing by Mr. Wheatstone himself), not only placed us on a footing of equality in point of invention, but had declared that to me alone the country is indebted for having "practically introduced and carried out the Electric Telegraph as a useful undertaking."

I have reprinted my pamphlet of 1854, as an appeal to the Public against a new act of injustice

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of the same kind. The success of the Atlantic Cable having been acknowledged by the grant of public honours to those by whom it was accomplished, the "Times" has been advocating a like concession to Professor Wheatstone. I should not grudge him any reward that he can obtain for what he really did; but I object to his being treated as the sole author of an invention which the judgment of our referees, and his own acknowledgment, have attributed equally to me.

I cannot but regret that the Editor of the "Times" should not have given admission to any one of the concise and temperate letters which have been addressed to him on my behalf.

I understand that it is the invention of the Electric Telegraph generally, which Mr. Wheatstone is still claiming. But lest he should attempt to narrow the issue to the submarine application of the telegraph, I have given, in an Appendix, some extracts, which prove that neither the idea, nor the accomplishment of submarine telegraphing, is due to either of us.

ABERIA, CARNARVON.
24th Oct., 1866.

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PREFACE TO THE FOURTH EDITION.

SINCE the publication, last month, of my Third Edition, I have heard that Professor Wheatstone's friends continue to assert, that, on the sale of the Patents to the Electric Telegraph Company, Mr. Wheatstone received less than what he was entitled to. I have, therefore, in the present edition (Appendix IV.), reprinted my former answer to this imputation; adding, at the very end of the book, a copy of the actual estimates on the basis of which the Electric Telegraph Company was formed—a document more convincing than argument, and which need not, at this distance of time, be any longer withheld from publication.

ABERIA, CARNARVON.
November, 1866.

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THE ELECTRIC TELEGRAPH,

ETC.

THOSE whose interest in the Electric Telegraph is lively enough to induce them to read the statement of facts contained in the following pages, need scarcely be informed, that the unwearied invisible messenger, now employed daily and nightly, by land and by water, in carrying the despatches of commerce and war to every corner of Europe, was first brought into the service of mankind by an invention for which an English patent was granted to William Fothergill Cooke and Charles Wheatstone, on the 12th June, 1837. America and Germany may have since put forth claims to the honour of the discovery, and some notes and hints in anticipation of it may have been brought together, within the last few years, from various parts of the world, to gratify the curiosity excited by its success; but no account of a practical Electric Telegraph, published or written at a date earlier than that of the specificationof the patent of June, 1837, has yet been produced.

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It has been supposed by many persons that this invention of the Electric Telegraph, in the year 1837, was the result of a lengthened process of investigation and experiment on the part of the eminent Professor named in my title-page, aided towards the end of his labours by a partner, variously misrepresented as the capitalist, the mechanic, or the man of business, with whom he is understood to have associated himself just before taking out his patent. Documents are now in the press which will tell a very different tale; documents which were already in print thirteen years ago, and of which a copy has remained in Professor Wheatstone's possession ever since. They will convince the most prejudiced, that it was not from his philosophical information, nor from his experimental ingenuity, that Professor Wheatstone acquired his position as one of the patentees of the first practical Electric Telegraph; but from a communication made to him in confidence by the writer, who was then completing the practical invention, and was about to take out a patent for it; who was in possession of practical Electric Telegraphs already made by him, and fit for practical use; who had worked out into a pamphlet a detailed practical system of electric telegraphing; who was in negotiation with a railway company for the practical application of the invention upon their line; and who, having consulted Professor Wheatstone (before the Professor had done anything

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practical at all) as a scientific man, on a scientific question affecting the proportions of part of the apparatus, and having tried experiments with him upon the point submitted for his advice, was induced, by the adviser's scientific acquirements, and by pecuniary considerations, to admit him to a share in the patent, as second partner. I may just mention by the way, that I was not a capitalist, nor a mechanic, nor a man of business, but a military man, lately returned from service in India, and wholly inexperienced in patents and business arrangements, to which, on the other hand, my scientific coadjutor was already accustomed.

It was at the end of February, 1837, that I consulted Mr. Wheatstone; and the patent was completed, as already mentioned, in the following June. Very soon afterwards, I arranged and put up an experimental telegraph to Camden Town, for which the Engineer and Directors of the London and Birmingham Railway Company had given an order, after witnessing a series of experiments, which we had tried at Euston Station by their permission, obtained through the influence of my friends. The invention at once became a subject of public interest; and I found that Mr. Wheatstone was talking about it everywhere in the first person singular. I remonstrated with him. I cautioned him as a friend that he was getting himself into a false position. At length,

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in 1840, I required that our positions, relatively to the invention and to each other, should be ascertained by arbitration. Arbitrators of eminent scientific attainments were appointed, by a formal legal instrument, to inquire into the facts and report the result. Elaborate statements were laid before them, and printed for their use. A volume of drawings, illustrating all the several forms and stages of the invention, was prepared and zincographed. The Arbitrators made their Award; Mr. Wheatstone subscribed his assent to it; but scarcely had it been published, when I heard of whispers in scientific circles that it was only a concession to quiet the business partner, and meant nothing. And so completely has it now been explained away, that a recent article in the "Quarterly Review," of evident research and apparent candour, ignores it altogether.

In April, 1841, two men, whose names might have obtained for their lightest opinion a candid consideration, and who are not now living to defend their judgment—the late Sir Isambard Brunel and Professor Daniell—with the fullest means of information before them, found me "*entitled to stand alone*," as the person "*to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of national importance.*" Professor Wheatstone deliberately ratified this decision. In June, 1854, the writer of

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the article in the "Quarterly," without mentioning any discovery, during the interval which has elapsed since the date of the award, of further evidence tending to a different conclusion, pronounces anonymously that Mr. Wheatstone is entitled to stand alone on the same ground. The Public will judge, when the papers are published, which of the two verdicts is the right one.

My present explanation, however, is not directed against the "Quarterly Review," but against Mr. Wheatstone. His egotism caused the misconception to which the Reviewer has given utterance. He must have seen the article published in June. H knew that it contained statements, in his favour and to my prejudice, contrary to the truth and to his own solemn admission. He might have contradicted these mis-statements in the September number of the Review: by allowing them to remain uncontradicted, he has virtually adopted them.

Nor is this my only charge against him. In the spring of 1843, by a new arrangement then made between us, I became the sole proprietor of the Patents, Mr. Wheatstone receiving, in exchange for his share, the grant of a liberal royalty on all lines of telegraph which should be constructed under them, with a discharge from present claims, and a dispensation from future liabilities. In my character of sole proprietor, I so managed the patents as to make his fortune, within three years after his retirement, by the sale for him on his

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own terms of the royalty reserved in his favour. On the sale of the patents to the Electric Telegraph Company in 1845, I made arrangements for his scientific connexion with the undertaking on a footing alike honourable and remunerative; a connexion which he himself terminated, in consequence of annoyances attributable to his own indiscretion (or perhaps misfortune), in his dealings with other inventors. Yet, after all this, he has allowed his friends to give out that, on the sale to the Telegraph Company, he was induced to part with his share in the patents at an inadequate price, under conditions by which the further exercise of his inventive talents was jealously prohibited.

He has perhaps inferred, from my long-continued silence, that no amount or repetition of provocation would induce me to come forward; or he has forgotten the contents of the arbitration papers. If my readers should be persuaded to follow me into the volume of documents which I am about to publish,* they will be only less surprised at my forbearance, than at the hardihood that has worn it out. For thirteen years, with the means of self-protection in my hands, I have allowed myself to be deprived, in the estimation of many persons whose good opinion I value, of the credit justly due to the origination of one of the great inventions of the age. I have remained quiet under misconceptions, always humi-

* *Note to Third Edition.* Published in 1856. (See Appendix.)

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liating, sometimes even obstructive in business. The errors of the article in the "Quarterly Review" are only a reproduction, in a mitigated form, of misstatements which I have passed over in fifty inferior publications. But I yield at length to the urgent representations of friends, who have interested themselves in the invention, and watched its progress, from the commencement; and in justice to those friends themselves, as well as to my family and connexions—to the high character of the Periodical which has been misled,* and to the honoured memory of the Arbitrators—I shall no longer hesitate to make public the overwhelming body of evidence which I have hitherto so patiently held back; avoiding, as far as possible, anything like a personal attack upon Mr. Wheatstone, though I cannot spare him the humiliation of retiring from a position, in which he ought never to have allowed himself to be placed.

Whether I am to throw the blame on the indiscreet partiality of his friends, or on his own scientific prejudices, or want of memory or of candour, it is evident, as a matter of fact, that he has possessed himself of the whole credit of having originated the Practical Electric Telegraph, for which we took out the Patent in June, 1837; though he knows and has admitted that I was the originator of it.

* *Note to Third Edition.* I have in my possession written proof that this article was "prompted exclusively by Professor Wheatstone."

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He has also caused or permitted a misrepresentation of the business arrangements of 1843 and 1845.

These being the two points on which I consider that he has compromised himself—the two charges, if I may so call them, which I have to prove; I shall proceed, without further preface, to extract from the article in the "Quarterly Review," above referred to, some portions of the erroneous statements which have induced me to lay my counter-statement before the Public. I shall next give the substance of the deed of reference under which the above-mentioned arbitration took place; and shall then set out the Award and Mr. Wheatstone's assent to it. These will lead me to explain the nature of the documents on which the Arbitrators founded their decision, and which are now in the press; and to give some extracts for the information of readers who may not have access to my larger publication. Having thus given a sketch of the evidence by which my first charge is made out, I shall pass on to a statement, in support of my second charge, of the circumstances under which Mr. Wheatstone's share in the Patents was assigned to me in the year 1843; of the arrangements made two years afterwards for the sale of his royalty on the formation of the Electric Telegraph Company; of his appointment as the Company's scientific adviser; and his resignation of that appointment.

To begin then with some extracts from the article in the "Quarterly."

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"A frequently renewed and still unsettled controversy has arisen upon the point of who is to be considered the first contriver of the Telegraph in the form which made it available for popular use. Two names alone are now put forward to dispute the claim with Wheatstone—Steinheil of Munich, and Morse of New York. From a communication of M. Arago to the French Academy of Sciences, it appears that the Telegraph of Steinheil was in operation, for a distance of seven miles, on the 19th of July, 1837, the same month in which Wheatstone put his own contrivance to the test upon the North-Western Railway. But besides that the Patent of Wheatstone was taken out in the preceding June, and was itself founded upon previous and thoroughly successful experiments, there is another material circumstance which gives him a claim to priority over Steinheil, viz., that the latter published no description of his instrument until August, 1838, that he altered and improved it in the interval, and that the only accounts we have of his contrivance describe its amended and not its original form. It was, however, a very meritorious performance, and, in addition to its other excellences, Steinheil was the first who employed the earth to complete the circuit—a most important fact, which we shall explain hereafter. Still his Telegraph was inferior in its mechanical arrangements to that of Wheatstone, and the inventor himself soon abandoned it in favour of a modification of the instrument of Morse."—Pp. 125-6.

"The question of priority is, in our opinion, after all of no sort of importance, at least as regards the rival claims of Wheatstone and Steinheil. When the progress of science has prepared the way for a great discovery, two geniuses will occasionally take the step together, because each is able to take the step of a giant. It was thus that

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the Calculus was found out by both Newton and Leibnitz, and the place of Neptune in the heavens by both Adams and Leverrier. It was the same with the Telegraph. The investigations of Wheatstone and Steinheil were entirely independent of each other, and it cannot lessen the merit of either that there was a second man in Europe who was equal to the task.

"There are some who dispute Professor Wheatstone's claim, by urging that, inasmuch as all the main features of the Telegraph existed before he took out his Patent, there was nothing left to invent. It is true that much had been done, but it is equally certain that there was much to do. When Wheatstone first directed his attention to electricity as a means of communicating thoughts to a distance, the telegraph was a useless and inoperative machine. He and his partner established as a working, paying fact what had hitherto been little better than a philosophic toy. To those who now disparage the Professor's labours we think it sufficient to reply by the admirable saying of the French *savant*, M. Biot—'Nothing is so easy as the discovery of yesterday; nothing so difficult as the discovery of to-day.'"—Pp. 126-7.

I will now make some extracts from the deed of reference.

"ARTICLES of AGREEMENT made this 16th day of November, 1840, between WILLIAM FOTHERGILL COOKE, - - - Esq., of the one part, and CHARLES WHEATSTONE, - - - Esq., of the other part.

"WHEREAS the parties hereto are the co-proprietors of certain English, Scotch and Irish patents granted to them, or one of them, in and since the year 1837, for an Inven-

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tion commonly called the 'Electric Telegraph,' and for improvements thereon: And whereas the said William Fothergill Cooke having represented to the said Charles Wheatstone that he the said W. F. Cooke, has been subjected to constant annoyance and serious injury by alleged erroneous notions, which have been (as he states) generally received of his position relative to the said C. Wheatstone, in consequence of alleged erroneous statements, alleged to have been contained in a long series of widely circulated publications; It has therefore been agreed between the parties hereto, upon the said W. F. Cooke's application, that the relative positions of the said parties should be ascertained by arbitration as hereinafter mentioned."

After mentioning a second subject of reference which has ceased to be of any importance, the deed proceeds:—

"Now these presents witness, that in consideration of the premises, it is hereby mutually agreed between the said parties hereto, as follows; that is to say—

"First, That MARC ISAMBARD BRUNEL, of the Thames Tunnel, London, Esq., shall be arbitrator on behalf of the said W. F. Cooke; and JOHN FREDERICK DANIELL, of Norwood, Surrey, Professor of Chemistry in King's College, London, arbitrator on behalf of the said C. Wheatstone, for the purposes hereinafter mentioned."

The second clause contains a power, which was not exercised, of appointing a third arbitrator; and the deed then states the principal subject of reference, in the following terms:—

"Thirdly. That the Arbitrators shall, with all convenient

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expedition, ascertain the relative positions of the said parties hereto, in the following manner, namely: The arbitrators shall investigate, and they or any two of them, shall conclusively determine by their written award, in what shares, and with what priorities and relative degrees of merit, the said parties hereto are co-inventors of the Electric Telegraph; due regard being paid to the original projection thereof; to the development of its laws and properties; to the practical introduction of it into the United Kingdom; to the improvements made upon it since its introduction there; and to all other matters which the arbitrators, or any two of them, shall in their discretion think deserving of their consideration."

Then follow various powers and formal clauses; the signatures and seals of the parties; and the attestations of their solicitors.

Five months after the date of the above deed of reference, viz., on the 27th April, 1841, Sir Isambard Brunel and Professor Daniell made their Award as follows:—

"As the Electric Telegraph has recently attracted a considerable share of public attention, our friends, Messrs. Cooke and Wheatstone, have been put to some inconvenience, by a misunderstanding which has prevailed respecting their relative positions in connection with the invention. The following short statement of the facts has, therefore, at their request, been drawn up by us the undersigned Sir M. Isambard Brunel, Engineer of the Thames Tunnel, and Professor Daniell, of King's College, as a document which either party may at pleasure make publicly known.

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"In March, 1836, Mr. Cooke, while engaged at Heidelberg in scientific pursuits, witnessed, for the first time, one of those well-known experiments on electricity, considered as a possible means of communicating intelligence, which have been tried and exhibited from time to time, during many years, by various philosophers. Struck with the vast importance of an instantaneous mode of communication, to the railways then extending themselves over Great Britain, as well as to government and general purposes, and impressed with a strong conviction that so great an object might be practically attained by means of electricity, Mr. Cooke immediately directed his attention to the adaptation of electricity to a practical system of Telegraphing; and, giving up the profession in which he was engaged, he, from that hour, devoted himself exclusively to the realization of that object. He came to England in April, 1836, to perfect his plans and instruments. In February, 1837, while engaged in completing a set of instruments for an intended experimental application of his Telegraph to a tunnel on the Liverpool and Manchester Railway, he became acquainted, through the introduction of Dr. Roget, with Professor Wheatstone, who had for several years given much attention to the subject of transmitting intelligence by electricity, and had made several discoveries of the highest importance connected with this subject. Among these were his well-known determination of the velocity of electricity, when passing through a metal wire; his experiments, in which the deflection of magnetic needles, the decomposition of water, and other voltaic and magneto-electric effects, were produced through greater lengths of wire than had ever before been experimented upon; and his original method of converting a few wires into a considerable number of circuits, so that they might transmit the greatest number of signals, which can be

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transmitted by a given number of wires, by the deflection of magnetic needles.

"In May, 1837, Messrs. Cooke and Wheatstone took out a joint English patent, on the footing of equality, for their existing inventions. The terms of their partnership, which were more exactly defined and confirmed in November, 1837, by a partnership deed, vested in Mr. Cooke, as the originator of the undertaking, the exclusive management of the invention, in Great Britain, Ireland, and the Colonies, with the exclusive engineering department, as between themselves, and all the benefits arising from the laying down of the lines, and the manufacture of the instruments. As partners standing on a perfect equality, Messrs. Cooke and Wheatstone were to divide equally all proceeds arising from the granting of licences, or from sale of the patent rights; a per-centage being first payable to Mr. Cooke, as manager. Professor Wheatstone retained an equal voice with Mr. Cooke in selecting and modifying the forms of the telegraphic instruments, and both parties pledged themselves to impart to each other, for their equal and mutual benefit, all improvements, of whatever kind, which they might become possessed of, connected with the giving of signals, or the sounding of alarums, by means of electricity. Since the formation of the partnership, the undertaking has rapidly progressed, under the constant and equally successful exertions of the parties in their distinct departments, until it has attained the character of a simple and practical system, worked out scientifically on the sure basis of actual experience.

"Whilst Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of

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national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches had already prepared the public to receive it as a project capable of practical application; it is to the united labours of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated.

M^{c} I^{d} BRUNEL.
J. F. DANIELL.

London, 27th April, 1841."

Before the signature of this Award, the draft of it had been handed to Professor Wheatstone for consideration, and, by his request, the particulars of his earlier experiments, as they now stand, had been added to the original form in his own words. To the Award thus amended, and which, being made by agreement, was a treaty as well as a decision,* Professor Wheatstone, under the advice of

* I cannot better illustrate the real nature of the Award, than by printing a letter which I wrote to Mr. Wheatstone's arbitrator, Professor Daniell, on the day before the final meeting of the 27th of April. The parts omitted have no bearing upon the question of invention.

" Kidbrooke Lodge,
" DEAR SIR, 26th April, 1841.

You have no doubt received a letter which I wrote to you to-day, requesting that a meeting might take place before Mr. Wheatstone's departure for the Continent, in order that we might at once conclude the basis of an amicable arrangement, and request Mr. Richardson and Mr. Wilson to lose no time in preparing such legal documents as might be necessary, or that we might come to a final understanding that an amicable settlement is unattainable,

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his able and experienced legal adviser, followed me in subscribing a cordial and grateful assent as follows:—

"GENTLEMEN, LONDON, 27th April, 1841.

We cordially acknowledge the correctness of the facts stated in the above document, and beg to express

---

and without further fruitless negotiations proceed with the arbitration immediately on Mr. Wheatstone's return.

I have since seen Sir I. Brunel, who has kindly agreed to devote any hour to-morrow to the subject.

That the Arbitrators and Mr. Wheatstone may be fully in possession of my views, I now hand you a final statement of what I will, and of what I will not, concede. At the last meeting at which I was present, the Arbitrators expressed strongly their anxiety to promote an amicable settlement. I cordially responded to their wish; and on being requested, as plaintiff, to state what I claimed, I prepared a memorandum for the signature of the Arbitrators and the parties. I there claimed the least which I think I can be expected to accept; and by that memorandum (which I again enclose) I am still willing to abide.

Professor Wheatstone has adopted the greater portion of it, but he has transposed the paragraph, so as to give precedence to his name. To this I cannot consent, as his connexion with the practical undertaking commenced (even by his own showing) at a comparatively recent date, and in consequence of my urgent invitation. The scientific field I left open to him in the most liberal spirit. I have, at your suggestion, expressed in different words the idea which I before intended to express by the word "Projector;" and I have also introduced Mr. Wheatstone's summary of his researches, and adopted some others of his expressions.

* * * * * *

I beg that these may be received as my final propositions.

* * * * * *

I am, dear Sir,

Yours very truly,

WILL^{M} F. COOKE.

J. F. DANIELL, Esq."

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our grateful sense of the very friendly and gratifying manner in which you have recorded your opinion of our joint labours, and of the value of our invention.

We are, Gentlemen,
With feelings of the highest esteem,
Your obedient Servants,
WILL[M] F. COOKE.
C. WHEATSTONE.

SIR M. ISAMBARD BRUNEL, and
J. F. DANIELL, Esq., Professor, &c. &c."

At the time when the Award was thus made and agreed to, Mr. Wheatstone and myself, our solicitors and the arbitrators, were each of us in possession of a printed book, containing—(1) my Case, or statement of facts: (2) Mr. Wheatstone's Case, or statement of facts: (3) my solicitor's opening address, or summary of evidence: also of a volume of zincographed drawings, with printed tables of reference to them. Almost the whole of the original impression of the cases and address was destroyed, by Professor Daniell's desire, to prevent publicity; but a few copies were preserved by the different parties to the enquiry, one of which I am now reprinting,* with the drawings, and my early pamphlet on the Electric Telegraph.

* The printed papers were placed at the disposal of the Arbitrators, by a written agreement, on that and other points, which was signed by the parties and by the Arbitrators, at the meeting of the 27th of April, immediately after the signature of the Award.

The same agreement threw all the expenses of the arbitration on the Partnership: a condition on which I insisted, as my outlay (including printing, drawing and zincographing) exceeded Mr. Wheatstone's tenfold.

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My statement of the facts, so far as they remain material, was shortly as follows:—Having returned from India on leave of absence, on account of the state of my health, and afterwards resigned my commission, I was studying anatomy and modelling my dissections at Heidelberg, when, in March, 1836, I happened to witness one of the common applications of electricity to telegraphic experiments, which had been repeated without practical result for half a century. Perceiving that the agent employed might be made available to purposes of higher utility than the illustration of a lecture, I at once abandoned my anatomical pursuits, and applied my whole energies to the invention of a practical Electric Telegraph, which, within three weeks, I accomplished in the telegraph designated "Part B" in the first sheet of the drawings, now in course of publication. I soon afterwards made another Electric Telegraph of a different construction, also shown in the drawings. In the summer of 1836, I worked out an entire practical system of electric telegraphing, in the pamphlet above referred to. In the winter of the same year, I made a conditional arrangement with the Liverpool and Manchester Railway Company, for the erection of an Electric Telegraph in the tunnel at Liverpool. In the following February, when about to apply for a patent, I asked the advice of Dr. Faraday and Dr. Roget on the construction of the electro-magnet employed in part of the apparatus, as explained below. Dr. Roget advised me to consult

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Professor Wheatstone, which I did on the 27th February, 1837. That Mr. Wheatstone had not yet got beyond the "philosophic toys" of his friend the Reviewer, appears by his own statement of what he had done, in the introductory part of the Award: where his "much" (fruitless) "attention to the subject" "for several years"—the old lecture-room experiments, annually repeated, yet remaining unapplied—his "greater lengths of wire than had ever before been experimented upon;" and his economical key-board, which has never been used—would seem to have been interpolated for no other purpose than to set off, by way of contrast, the practical realities of my "plans and instruments." He eventually joined me in the patent; in which my name took the lead; towards the expense of which he contributed more than half; and which was charged in my favour with £130 for the expenses of my past experiments, without any allowance to Mr. Wheatstone for any past experiments of his. Whereas afterwards, in 1839, when his experiments had mainly led to the completion of materials for a second joint-patent (supposed at the time to be of value, but which has not come into use), he asked and obtained priority for his name, and an allowance for his expenses.

Facts thus conclusive in themselves were rendered, if possible, doubly conclusive, by Mr. Wheatstone's attempts to explain them away. In the

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Case which he laid before the Arbitrators, he imprudently committed himself to a great number of particular statements, about things which had been done, and things which had been said; statements not very material perhaps if well founded, but the incorrectness of which was conclusively proved by documentary and circumstantial evidence. On the one side, was a simple narrative, probable in itself and consistent with circumstances, and supported by documents and instruments, and by the personal knowledge of numerous respectable witnesses: on the other side, a series of plausible but unsupported assertions, all of which were disproved. I venture to say, that no candid person can read my Case without believing it; nor Mr. Wheatstone's Case, with my solicitor's summary of the evidence in answer to it, without full conviction that every material part of the Case is incorrect, and that the answer is beyond the reach of a reply.

A summary of evidence, and more especially one of circumstantial evidence, is in its nature scarcely susceptible of abridgment; nor could extracts of individual instances, of statements inconsiderately made and conclusively answered, convey a just notion of the whole effect of an argument which deals in like manner with a score of such instances besides. Yet, as I cannot expect to persuade any great number of persons to read the documents themselves, I must extract some portions of narra-

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tive from my Case, for the information of a class of readers who may be willing to follow me through a pamphlet, but who would be deterred by the expense and bulk of a volume. I will begin by extracting, from the earlier part of my Case, a letter which I wrote to Professor Wheatstone two or three years before the arbitration, as follows:—

"My dear Sir, 22nd August, 1838.

I was surprised to hear this morning that the Association had already met; having anticipated some communication from you before your departure from London, under the supposition that you would introduce the Telegraph to the notice of the *savans* there assembled. I have long been annoyed by the urgent requests of my friends to publish my claims to the invention, but invariably declined; more recently, a well-known scientific personage has been most urgent to bring it forward at the present meeting, but I have refused, for two reasons; first, as I believe an invidious feeling rather than zeal in my cause dictated his offer, but more especially as I prefer leaving my cause entirely in your hands, and thereby evincing my sense of the confidence you have placed in me by entrusting your pecuniary interest in the patent to my honour and control. So great a publicity has been given to the subject, that I cannot doubt it will be made a prominent topic in your section, which will give you the most favourable opportunity of placing the facts briefly before the public in their true light. I believe you have ever considered me as the individual, by whose solitary exertions, for a lengthened period, the system was prepared for practical application, in other words, as the Projector; and I employ your frequently repeated expression in saying that

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you consider us on an equal footing as inventors. The former post as Projector explains most satisfactorily to the world why my name takes the lead in the patent, without casting the slightest shade over yours as a scientific man. Do, my dear sir, make a point of settling this question in the manner which your own feelings as a gentleman and a man of science will dictate, that it may rest henceforth and for ever: our mutual good understanding, which I trust has been gradually strengthening, will be confirmed by this step. It is finally determined that iron and lead tubing are to be employed only, on the Great Western Railway; a large supply of materials will be ready in a few days, when I expect to proceed rapidly.

Yours faithfully,
WILL^{M} F. COOKE.

C. WHEATSTONE, Esq."

The incident which first turned my attention to the Electric Telegraph, is thus mentioned in the Case:—

"In the month of March, 1836, I was engaged at Heidelberg in the study of anatomy, in connexion with the interesting and by no means unprofitable profession of anatomical modelling; a self-taught pursuit, to which I had been devoting myself with incessant and unabated ardour, working frequently fourteen or fifteen hours a day, for about eighteen months previous. About the 6th of March, 1836, a circumstance occurred which gave an entirely new bent to my thoughts. Having witnessed an electro-telegraphic experiment, exhibited about that day by Professor Müncke, of Heidelberg, who had I believe

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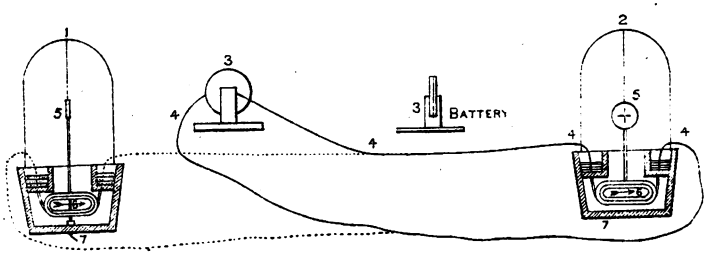
ILLUSTRATION TO THE THIRD EDITION.

Documents, Vol. II. (See Appendix.)

Professor Muncke's Instrument (found by Dr. Hamel, at Heidelberg, in 1859.)



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taken his ideas from Gaüss,* I was so much struck with the wonderful power of electricity, and so strongly impressed with its applicability to the practical transmission of telegraphic intelligence, that from that very day I entirely abandoned my former pursuits, and devoted myself thenceforth with equal ardour, as all who know me can testify, to the practical realization of the Electric Telegraph; an object which has occupied my undivided energies ever since."

Then follows a description of Professor Müncke's experiment, which I will extract, after a few words of general explanation for the benefit of such of my readers as may happen to be unacquainted with the principles on which telegraphing by electricity is founded.

If some pieces of copper and zinc are arranged alternately in a trough, partially filled with acidulated water or wet sand, they form what is called a *voltaic battery;* and if, from the copper at one end, a piece of wire, or *metallic circuit*, is carried for a greater or less distance round to the zinc at the other end, a current of electricity immediately passes through the wire, and continues to flow while the connection is maintained. If the wire be cut in two, the current instantly ceases to flow; it begins again when the parts are brought together, and so on. Now, for a long time before the invention of the Electric Telegraph, it was well known that if a common magnetic or compass needle were

* *Note to Third Edition.* From Baron Schilling, not from Gaüss.

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suspended near and parallel to the wire, the passing of the current through the wire would have a tendency, during the continuance of the current, to make the needle change its position, and hang across the wire instead of parallel to it. It was also well known, that this *deflecting* force of the electric current could be *multiplied*, by coiling the wire many times round a space containing the needle: the wire being *insulated* by being covered with a non-conducting material, so as to ensure the passing of the current through the whole length of the wire, without finding a shorter passage across at some point of contact in the coil. And this well-known multiplied deflecting power was in common use, in an instrument called a *galvanometer*, for measuring the force of an electric current.

It was also well known, long before the invention of the Electric Telegraph (known, that is, to scientific men, for all was new to me), that if an insulated wire were coiled round a piece of soft iron, the passing of an electric current through the wire would cause the iron to attract other iron like a magnet; the attractive force of this *voltaic* or *temporary* magnet, or *electro-magnet*, ceasing with the cessation of the electric current. But to return to the Case.

"Professor Müncke's experiment was at that time the only one upon the subject that I had seen or heard of. It showed that electric currents, being conveyed by wires to

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a distance, could be there caused to deflect magnetic needles, and thereby to give signals. It was in a word a hint at the application of electricity to telegraphic purposes; but nothing more, for it provided no means of applying that power to practical uses. His apparatus consisted of two instruments for giving signals by a single needle, placed in different rooms, with a battery belonging to each; copper wires being extended between these two termini. The signals given were a cross and a straight line, marked on the opposite sides of a disc of card, fixed on a straw; at the end of which a magnetic needle was suspended horizontally in galvanometer coils, by a silk thread. The effect of this arrangement was, that if a current was transmitted from either battery, when the opposite ends of the wires were in connexion with the distant telegraphic apparatus, either the cross would be there exhibited by the motion of the needle one way, or the line by its motion the other way, according to the direction of the current. The apparatus was worked by moving the ends of the wires backwards and forwards between the battery and the coils."

The Case then proceeds to describe my first Telegraph, as follows:—

"Within three weeks after the day on which I saw the experiment, I had made, partly at Heidelberg and partly at Frankfort, my first Electric Telegraph, of the galvanometer form, which is now at Berne. It has been written for, and shall be laid before the arbitrators. I used six wires, forming three metallic circuits, and influencing three needles. I worked out every possible permutation and practical combination of the signals given by the three needles, and I thus obtained an

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alphabet of twenty-six signals. I had invented the instrument which I called the DETECTOR; by means of which injuries to the wires, whether from water, fracture, or contact, are readily traced; an instrument which in practice is never out of my hand, and without which the Electric Telegraph would be impracticable. But my principal improvement was, that my Telegraph did not merely send signals from one place to another, but that it was, even at that early period, a *reciprocal telegraphic system*, by which a mutual communication could be practically and conveniently carried on between two distant places; the requisite connections and disconnections being formed by pressing the fingers upon keys, and the signals being exhibited to the person sending, as well as to the person receiving, the communication. This improvement was effected by placing a system of keys permanently at each extreme end of the metallic circuit, and by providing each circuit with a cross-piece of metal for completing the continuity of the wires when signals were being received from the opposite terminus. The two signal apparatuses being thus thrown into the course of the metallic circuit, every signal was given at both ends concurrently; and the cross-piece was made to restore the circuit for a reply, on the first communication being completed. This united and reciprocal property is the basis of the Electric Telegraph, and is inseparable from the practical system. It has been my leading principle throughout, and has impressed itself even upon the forms of my instruments; their distinguishing characteristic from first to last being, that my keys and signals have always been joined together into one instrument, and the several instruments into one reciprocal system. In a word, the Arbitrators will here recognize the earliest form of the RECIPROCAL COM-

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MUNICATOR, the fundamental condition of the Electric Telegraph under every varied mode of its operation."

The Alarum is thus described :—

"My earliest apparatus thus comprised, in a complete though improvable form, two essential parts of my system of a Practical Electric Telegraph; viz., the Detector and the Reciprocal Communicator: a third, of equal importance, is the ALARUM, without which the Electric Telegraph would require to be constantly watched like ordinary telegraphs.

"Before the end of March, 1836, I had invented the Alarum, which is still extant in my first Mechanical Telegraph. It was one of ordinary construction, worked by clockwork mechanism on a removal of a detent. My invention consisted in placing a voltaic magnet in such proximity to an armature of soft iron forming the tail-end of a lever detent, that when an electric current passed round the voltaic magnet, the magnetism which was for the moment excited in it attracted the tail-end of the lever, and by so doing drew its detent-end out of the clockwork; but on the temporary magnetism ceasing with the cessation of the current, the attraction of the tail-end of the lever ceased also, and the detent-end of it was then replaced in the clockwork by a reacting spring or balance weight."

The origin and principle of the "Mechanical Telegraph," referred to in the last extract, are explained as follows :—

"The principle of removing a detent by magnetic attraction, and replacing it by mechanical reaction, was not,

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however, confined to the Alarum, but on the contrary it was the basis of my Mechanical Telegraph itself. The first idea of it suggested itself to my mind on the 17th March, 1836, during my journey from Heidelberg to Frankfort, when reading Mrs. Somerville's work on the Physical Sciences; and the Arbitrators will find that I immediately afterwards applied the idea to a musical snuff-box, being almost the only piece of mechanism I was then acquainted with. The striking advantage held out by the mechanical, in comparison with the galvanometer form was, that whereas the mode of giving signals by combinations of magnetic needles, each acted upon directly and separately by an electric current, involved the necessity of using several circuits, and consequently the expense of several wires; on the other hand, if the electric agency could be confined to the office of causing suitable interruptions or divisions in any kind of motion derived from an independent source, the necessity of a plurality of circuits would be avoided, for the diversity of the signals would then depend upon the mechanism."

Though some degree of interest may attach to this, the earliest application of temporary magnetism to exhibit visible signals by letting off clockwork mechanism at a distance (for this mode of signalling, whether to the ear or to the eye, was new in principle when I adopted it), the "Mechanical Telegraph," with all its apparent advantages, and notwithstanding the endeavours of ingenious persons to render it available, has not come into use, to any considerable extent at least, in this country. The visible signals are

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still given by the deflection of magnetic needles, and the electro-magnet is confined in practice to the Alarum.

The narrative is continued to the beginning of 1837, as follows :—

"During the months of June and July, 1836, I employed my leisure moments in working out the details of my system into a written pamphlet or sketch, which is extant, and the date of which can be clearly proved. The Arbitrators will learn from it that (as early as July, 1836) I had, in anticipation, worked out my practical system from the minutest official details, up to the remote and extended ramifications of an important political and commercial engine.

"Towards the end of 1836, my mechanical instrument was nearly completed, and my funds nearly exhausted. Finding it, therefore, necessary either to turn my invention to an immediate profitable result, or to draw upon the resources of my friends, and preferring the former alternative, I obtained an introduction to several of the leading gentlemen connected with the Liverpool and Manchester Railway, and submitted to them, in January, 1837, my pamphlet and mechanical instrument, with a view to the practical adoption of the Telegraph in a tunnel for which some mode of conveying signals was required. The correspondence connected with this, my first endeavour to apply the Electric Telegraph to railways, will be laid before the Arbitrators.*

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* This correspondence included a letter from Dr. Reynolds, of Liverpool, which I print as a contemporaneous expression by a scientific man of the general state of opinion as late as January,

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"Before taking my instrument into the North, I showed it in November, 1836, to Dr. Faraday, who kindly called at my lodgings in the Adelphi for the purpose of looking at it, and encouraged me by an assurance that I was right in principle.

1837, many years after the commencement of Mr. Wheatstone's experiments, on the subject of telegraphing by electricity :—

"My dear Sir,

I have examined the papers which you sent to me describing the Electro-Magnetic Telegraph. The Author does not explain the mode in which he proposes to apply this power to effect his purpose. There can be no doubt that electricity, from whatever source it may have been derived, can be transmitted to a distance however great, by means of a copper wire, in a space of time almost imperceptible. Mr. Wheatstone calculates that it travels at the rate of *four million feet in a second.* The electro-magnetic apparatus possesses many advantages over all other methods with which we are acquainted of affording electricity—it is simple in its construction, not liable to be influenced by states of the atmosphere, or to get out of order. Supposing, therefore, that an isolated wire were extended from Liverpool to London, we might transmit electricity from one place to the other with the greatest rapidity and regularity ; but how this power or agency can be applied to communicate signals to the extent required, I cannot conceive ; and on this point Mr. Cooke is silent, no doubt intentionally, as in this evidently consists the essence of the invention, and he very naturally must wish to secure some advantage from his discovery, before making it public. He appears to have bestowed much thought and labour on the subject; and some of his contrivances are very ingenious. I was particularly struck with his mode of detecting the defective place, should the wire be broken at any part—it is for this purpose that he makes use of the index or dial given in his book. He appears to me, however, to under-rate the practical difficulties of maintaining a wire extending for many hundred miles, in a state of perfect integrity and electrical isolation ; and unless he has two wires of communication, he would, I conceive, be liable to the inconvenience of the parties at each extremity signalising at the same moment of time, and the effect being thus destroyed.

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"The Directors of the Railway Company thought my instrument, which was calculated to give 60 signals, of too complex a nature for the purpose of conveying a few signals along a tunnel; and therefore proposed that I should arrange one adapted for their purpose. I immediately designed and drew the second form of the mechanical telegraph, which was based upon the same principles as the first, but being calculated to give fewer signals was less complex. I returned to London immediately afterwards, and directed four instruments of the simpler form to be begun; which were soon afterwards made, and are extant. I had two of them working together at the close of April, 1837."

The circumstances under which I consulted Mr. Wheatstone, and the particulars of our earlier interviews, are thus stated:—

"While my four simpler mechanical instruments were being made, I employed myself in trying experiments upon the Electro-magnet, with a view to discover at what distance an electric current would excite the temporary magnetism required for moving the detent of the mechanism. For this purpose, I adjusted above a mile of wire in the chambers of Mr. Lane, in Lincoln's Inn; but the magnets and battery being ill-proportioned, my experiments were unsatisfactory. In this scientific difficulty I

Should you feel any wish to see an electro-magnetic machine, I have one at the Institution, which I should have much pleasure in exhibiting to you.

I am, my dear Sir,

Very truly yours,

WM. M. REYNOLDS.

Bedford Street, 26th January, 1837.

JOS. N. WALKER, Esq., Calderstone."

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sought the assistance of Dr. Faraday, who advised me to increase the number of the plates of the battery proportionably to the length of the wires; an expedient which in some degree overcame the defects of the magnets. I also consulted Dr. Roget upon the same scientific point; explaining my motives, but without showing my instrument to him.

"Dr. Roget informed me that Professor Wheatstone had a quantity of wire at King's College, which might assist me in trying experiments upon the electro-magnet, and he advised me on that account to submit my difficulty to him. Using Dr. Roget's name as an introduction, I accordingly called the same day upon Professor Wheatstone at his residence in Conduit-street (on the 27th February, 1837); on which occasion I asked his advice upon the point which I had before submitted to Dr. Faraday and Dr. Roget. In the course of conversation, Professor Wheatstone intimated that he had long been engaged in experiments himself, to show at what distances signals could be given by electricity, to be applied to telegraphic purposes. Upon his thus introducing the subject of a telegraph, I felt myself bound to caution him that my inquiry had reference to the same object, and that I was about to take out a patent for an Electric Telegraph.

"He politely invited me to King's College, where I found that in connexion with about four miles of wire, he was in the habit of using two galvanometers of different constructions, in his experiments on the effects of electric currents in deflecting magnetic needles. He had no apparatus of any kind for giving signals; but he had two key-boards, one of which was occasionally used in our experiments.

"What he had done towards inventing the Practical Electric Telegraph was confined to the "permutating prin-

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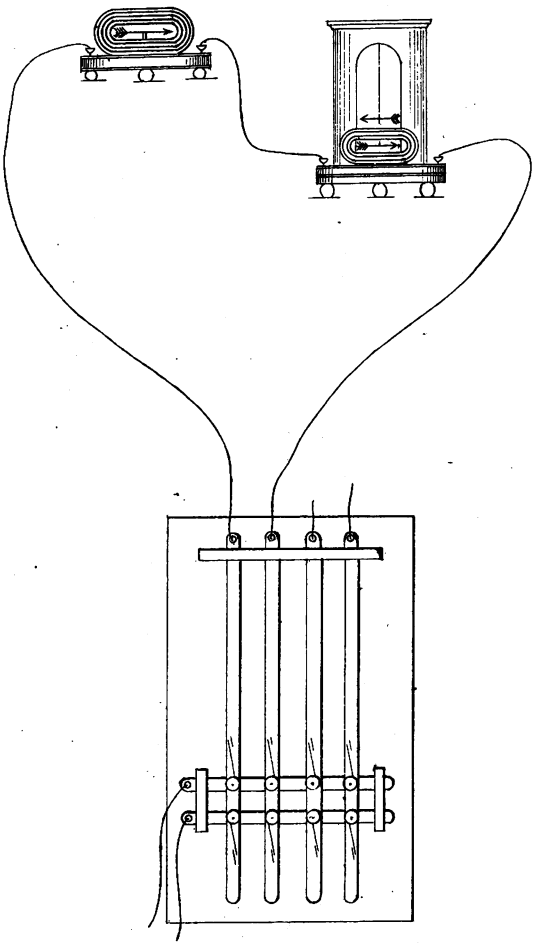
ILLUSTRATION TO THE THIRD EDITION.

Documents, Vol. I., p. 155. (See Appendix.)



Plan of Professor Wheatstone's Permutating Key-board, being his only telegraphic instrument at the commencement of the partnership: shown in connexion with a Melloni's galvanometer, and a common coil, used in his experiments.

His visitors at King's College in 1836 *and* 1837 *will recognise the accuracy of this sketch.*

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ciple" of his key-boards. This principle, which diminished the requisite number of wires, was engrafted on my Reciprocal Telegraph, and became very valuable in connexion with later improvements; but though diminishing the number of wires, the permutating keys by themselves, and without the later improvements, would have been more complex than my first galvanometer keys; for each of the latter gave two signals by a single needle (the plan now adopted on the Blackwall Railway), while the former required the concurrent action of at least two keys and two needles.

"Though Professor Wheatstone was, when I first consulted him, in possession of a valuable principle, he had gone no further. Except in the permutating principle, he was, practically, behind Münckè; for the latter had an instrument for giving signals, and Mr. Wheatstone had none. Even had all his apparent intentions been worked out, he would not then have fulfilled any of the fundamental conditions of the Practical Electric Telegraph;—the power of detecting injuries to the wires, by fracture, water or contact; of attracting attention at the commencement of the communication; of sending signals alternately backwards and forwards by the same apparatus; and of exhibiting the signals to the operator, as well as to the recipient. In a word, he had no detector; no alarum; no reciprocal communicator."

The above-mentioned interviews resulted in the formation of a partnership as follows:—

"Eventually, our partnership was formed at Mr. Lane's Chambers in Lincoln's Inn, early in May, 1837; and Mr. Lane will prove that a very long discussion then took place between Mr. Wheatstone and myself as to money

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matters, and afterwards, a very long discussion as to the priority of names in the patent. Mr. Wheatstone's own contemporaneous writing proves,

1st, That with his written consent my name took the lead.

2nd, That he paid £80 and I only £50 towards the expense of the patent: and other contemporaneous written evidence will show that any surplus was to be divided, not in these proportions, but equally.

3rd, Mr. Wheatstone's own writing also proves that I was allowed £130 for past experiments.

"These are FACTS which cannot be disputed, whatever may be the effect of them. Professor Wheatstone was allowed *nothing* for his experiments; yet, in the recent letter, already quoted, he rests his claim to maintain his generally received position, as inventor of the Electric Telegraph, mainly upon the ground that 'he alone, unaided, before he was acquainted with me, had carried into effect, *at a very considerable expense compared with his then limited means*, the extensive experiments on which all his subsequent researches have been founded.' His not having claimed anything for the expensive experiments which he had made before the commencement of our partnership, presents a striking contrast to his conduct at a later period; when having, in the year 1839, brought a particular series of experiments to a practically useful issue, he asked and obtained an allowance of £100 from the partnership for his expenses in those particular experiments, upon the express ground of the above original allowance to me; although at the time our legal agreement would have enabled me to refuse him any allowance."

The circumstances which immediately led to the

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arbitration are stated in the Case at considerable length. I extract the following passages:—

*** "The present arbitration is the immediate offspring of Professor Wheatstone's rejection of a remonstrance admitted to be 'written with temper,' made by me to him, by a letter dated the 20th October last, against a paragraph which was widely circulated in several papers in that month. The paragraph contained an eye-witness's account of certain experiments exhibited by him at Brussels. It was headed, in some papers at least, 'Professor Wheatstone's Electrical Telegraph,' and without once intimating his connexion with a partner, ascribed to him the entire invention. The answer which I received was, that 'of the paragraphs' which had been so widely circulated that even comparative strangers had obtrusively called my attention to them, Professor Wheatstone 'knew nothing; they might be right or they might be wrong; but he had given them no sanction.'

"Some months previously, the fourth Report of the Select Committee on Railways, dated the 2nd July last, was publicly circulated. It was made in the course of an inquiry into those practical questions which had formed my exclusive department. It was made upon Professor Wheatstone's own evidence, some of which was given from information received by him from me, and at a time when he knew that at the request of Mr. Saunders, the Secretary of the Great Western Railway Company, I was waiting at the door of the Committee-room to give evidence if called in. I have no means of showing what his evidence really was, for it was corrected by him with the express view of removing any ground of complaint on my part, and the original notes cannot be obtained while Parliament is not sitting; but even as corrected and printed, the evidence

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is objectionable. Whatever were the words used by him, it is certain that his evidence conveyed to the mind of the Committee, some of whom were his personal acquaintances, and had seen his experiments at King's College, a totally wrong impression, as appears by the following extract from the Report:—

'It appears, that on the Great Western Railway, experiments have been made to a considerable extent, with a view of ascertaining the best means of conveying intelligence through the medium of electricity.

'Mr. Wheatstone, Professor of Experimental Philosophy in King's College, has for some years turned his attention to this subject, and has, in conjunction with Mr. Cooke, obtained patents for his invention. From his evidence, which is especially deserving of notice, it appears that there is no difficulty in conveying intelligence to any part of the island with an almost instantaneous rapidity, by means of a few copper wires and small galvanic batteries. There is great ingenuity in the various modes in which Mr. Wheatstone has applied the power of electricity to alphabetical communication.'

"The impression embodied in the above Report existed at the time Professor Wheatstone gave his evidence, as appears by the first question put to the next witness, C. A. Saunders, Esq., viz.:—

'As the Secretary of the Great Western Railroad Company, can you state to the Committee whether they have adopted Mr. Wheatstone's Magnetic Telegraph?'

* * * "About the time the Report of the Committee was made public, an article appeared in 'Chambers' Edinburgh Journal,' of the 25th July last, founded upon experiments which had been exhibited, and explanations which had been given to Mr. Chambers at King's College by Professor Wheatstone; and before the article appeared, Mr. Chambers had written to Mr. Wheatstone, as the latter

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himself told me, for additional information; but his letter was not answered, because Mr. Wheatstone thought he was going to publish. Here, then, is an article emanating immediately from Mr. Wheatstone's own experiments at King's College, exhibited and explained by himself to the author; an article very widely circulated, expressly upon his own authority, and not until after a written application for further information. Surely here I might have expected to find that Mr. Wheatstone gladly availed himself of an easy opportunity of correcting the misapprehensions which have been repeatedly brought under his notice. On perusing an article of four columns, in which my name is not once mentioned, nor the remotest hint given that Mr. Wheatstone has a partner, the Arbitrators will find it stated that he has now made the Electric Telegraph his own; that the first patent was effected by him alone; that he has now superseded it by the third patent, which is also represented to be his alone; that my detector, nay, even my modes of insulating and laying down the wires—my very application (the result of many a disappointment) of iron tubes—the entire invention and every part of it, are all attributed, without exception or qualification, to Mr. Wheatstone alone. * * *

* * * "I felt myself now peremptorily called upon to vindicate, without further delay, my connexion with the invention. * * * I did not charge him with having caused the reports of which I complained; but only brought again and finally under his notice his obligation to correct the mistaken impression, which (from whatever cause it had arisen) certainly existed, and was certainly injurious to me. I made use of the following expressions:—'Allow me to add, that however your erroneous position may have originated, you yourself become responsible for it when you decline to recede from it. A continued neglect to contradict mis-

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statements which have been circulated in your favour, and by parties receiving their information personally from yourself, can only be construed as a voluntary retention and appropriation to yourself of what you know, and have repeatedly admitted, to belong to another in common with you; nor can it redound to the credit of your liberality if you sanction, by your silence, even an unauthorised misapplication of your influence in the scientific world to repress and conceal the merits of a comparatively unknown colleague.'"

I began my extracts with a gentle and friendly remonstrance, addressed to Mr. Wheatstone before the arbitration was resorted to. I will conclude them with a specimen of my later protests against the efforts of his friends to explain away the Award. It is taken from a letter of the 16th January, 1845.

"It is now nearly two years since I remonstrated with you on the endeavours which your friends were making to undermine the award of Sir Isambard Brunel and Mr. Daniell, of April, 1841; but as these remonstrances were met by the assurance of your solicitor (made in your name and by your expressed desire) in his letter of the 20th May, 1843, that there was no truth in the report that you denied your full consent to the declarations contained in the printed paper—an assurance further confirmed by his letter of the 27th June, in these words; 'Mr. Wheatstone does not desire to escape from a single conclusion which the Award warrants;'—all I could do, was to express myself satisfied with an explanation so unqualified.

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"The same cause of complaint has, however, been repeatedly obtruded upon me since. And I now hear from your own lips, that you have absolutely armed yourself with a letter from Mr. Daniell to counteract a certain construction of the Award, which you consider objectionable!

"This is indeed an alarming document to hold in reserve; and how Mr. Daniell could reconcile any such letter with the character of a Judge, remains to be explained."

I have never been permitted to look at this "alarming document;" but even if Professor Daniell did express himself incautiously in writing to his friend, no one acquainted with his manly and upright character can suppose that he intended to sanction a clandestine use of his letter to assist Professor Wheatstone's "escape" (in the words of his solicitor) "from a single conclusion which the Award warrants."

When Mr. Wheatstone has accounted for the priority of my name in the first patent, and for his own subscription to the Award, I shall be ready to discuss with him, *if he desires it*, our "shares," "priorities," and "relative degrees of merit" in the later developments of the invention. Confining myself for the present to the invention which was exhibited to the Arbitrators, and to the words of my original statement respecting it, I pass on to the business arrangements of 1843 and 1845.

Mr. Wheatstone has allowed his friends to speak

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of the arrangements of 1845, as if, retaining at that time his original half share of the patents, he had received less than half the consideration paid by the Electric Telegraph Company for the purchase of them. There is here what lawyers call a *suppressio veri;* the truth being, that in 1845 Mr. Wheatstone had no share in the patents at all, but only a royalty, which he then parted with at his own price.

His altered position in this respect was the result of the arrangement made in 1843, as already mentioned, by which I took the patents off his hands, releasing a claim which I had against his share, and granting him an ample royalty, without pecuniary responsibility, on all future telegraphs.

This new agreement was embodied in a deed, dated the 12th April, 1843, of which I will state the substance, curtailing legal verbiage.

After reciting the patents and the original partnership agreement, it goes on to say, that "the shares of the said C. Wheatstone in the - - - letters patent are subject to certain claims to a considerable amount, in favour of the said W. F. Cooke, for monies already advanced and paid by him - - - on account of the expenses of obtaining certain of the same letters patent and inrolling the specifications - - - and on other accounts."

Then follows a recital, that "it having been found that the complicated character of the aforesaid arrangements has tended to impede the suc-

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cessful prosecution of the said inventions, it was lately proposed and agreed - - - that all the letters patent, - - - and also all - - - patents for improvements - - - should be absolutely assigned - - - to the said W. F. Cooke; - - - and that in lieu of such interest of the said C. Wheatstone, - - - the said claims now affecting the same should be cancelled, and that there should be secured to him an allowance or royalty, in money, proportioned to the number of miles over which the said Electric Telegraph should be laid down by the said W. F. Cooke, his executors, administrators or assigns, or by or under licenses from the said W. F. Cooke, his executors, administrators or assigns."

The deed then "witnesseth" that "the said C. Wheatstone doth - - - assign - - - unto the said W. F. Cooke, his executors, administrators and assigns - - - the several letters patent - - - and all the privileges - - - thereby conferred, - - - and all the - - - shares - - - of him, the said C. Wheatstone, - - - in - - - the - - - letters patent - - - To the intent that the - - - letters patent - - - may be henceforth the sole property of the said W. F. Cooke, his executors, administrators and assigns - - - during all the residue of the respective terms of years granted by the same letters patent respectively, - - - and - - - during all extensions thereof. - - -

Further on in the deed I am bound, by pages of very stringent clauses, to account every January and July with Mr. Wheatstone for a royalty in his

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favour, on the operations on the preceding half-year, assessed at the following liberal rates:—

For the first ten miles of Telegraph completed during the year	£20 per mile.
For the second ten miles . .	£19 per mile.
For the third ten miles . .	£18 per mile.
For the fourth ten miles . .	£17 per mile.
For the fifth ten miles . . .	£16 per mile.
And for all beyond	£15 per mile.

The deed concludes with a release to Mr. Wheatstone of the balance due from him to me.

Passing on to the autumn of 1845, when the formation of the Electric Telegraph Company was in contemplation, Mr. Wheatstone then fixed his own terms for the sale of his royalty, and explained how he arrived at them, by the following letter:—

"20, Conduit Street, August 2, 1845.

"My Dear Sir,

I have thought over your propositions, and after due consideration have arrived at the following conclusions. I will commute my royalty on *all* lines in England (and Wales) for the sum of £20,000, the royalty on lines completed before the payment of the first instalment of £10,000, to be paid to me under the present arrangement. The grounds of my calculation are these: 1st, that thirteen railway lines, averaging 100 miles each, would realize to me the above sum: 2ndly, that at the rate even at which lines have been completed during the first six months of the present year, the sum I have named would be realized in four, or at the utmost, five years: circum-

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stances may augment or diminish this income, but I consider the chances of increase and decrease equal: 3rdly, that whatever arrangement be made for the sale of the Patents to other parties, the agreement with them cannot affect lines established previous to the date of such agreement.

If the Great Western Railway, and the portion of England south of this line and the Thames be excluded, I would fix the commutation at £16,000.

I will for a further sum of £10,000 give up all my rights in Scotland, Ireland, and Belgium, with all my reserved rights under the English Patents; or I will make a separate arrangement for any one or more of these privileges.

I wrote by last night's post to Mr. Quetelet, to ask when he leaves Brussels, and when he returns; if it be possible to arrive there a few days before he leaves, I will start directly; but it will be of no use for me to be in Belgium when my most influential friend is absent.

Yours faithfully,

C. WHEATSTONE.

To W. F. COOKE, Esq.

P.S.—These propositions to be of no effect unless agreed to within a month from the present date.

C. W."

Some further correspondence took place on points of detail, but the terms themselves were in all points of substance agreed to as at first proposed in Mr. Wheatstone's letter. He received the £30,000 which he asked, together with all arrears of royalty.

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But it has been said that the arrangements of 1845 precluded Mr. Wheatstone from continuing his important and meritorious telegraphic experiments. To this I answer, that both the deed of 1843, and the deed of 1845, bound Mr. Wheatstone very properly and reasonably—and bound him by almost the same words at each date—to give to the purchasers of the patents the benefit of all future improvements.

This usual clause, which in fact only sold with the patents a privilege which we have given away gratis, as a matter of course, to every railway company that has taken a licence, occurs in the deed of 1843, omitting technicalities, as follows—the same form being adopted in the deed of 1845, with a few immaterial verbal differences :—

"The said Charles Wheatstone doth - - - covenant - - - with - - - the said Wm. F. Cooke - - - that if he - - - shall - - - during the - - - terms of any - - - of the - - scheduled Letters Patent invent - - - any improvement in or addition to the - - - inventions mentioned - - - in the - - scheduled letters patent - - - although such improvement or addition should have the effect of entirely superseding the - - - original invention - - - provided only that it be applicable to the giving, printing, stamping, or otherwise transmitting of signals, or the sounding of alarums, or the communication of intelligence wholly or partially by means or through the agency of electricity, magnetism, or electro-magnetism: In every such case the said Charles Wheatstone will - - - make a full and open disclosure thereof to the said William Fothergill Cooke - - - and will keep the same secret from all other persons - - - And will, upon

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the request and at the expense of the said W. F. Cooke - - - (the said Charles Wheatstone's expenses - - - being always allowed on a liberal scale) forthwith apply for - - - letters patent - - - in respect of - - - such improvement or addition: And - - - assign - - - such - - - letters patent unto the said William Fothergill Cooke, his executors, administrators, and assigns, as and for his and their absolute property."

But so far from prohibiting the exercise of Mr. Wheatstone's inventive talents, the promoters of the Electric Telegraph Company especially requested me to engage him as the Company's scientific adviser and assistant, on very liberal terms; and a memorandum to that effect was signed, and for a time acted on.

Mr. Wheatstone, however, soon resigned his appointment, under the following circumstances:—

A Bill for the incorporation of the Company, which was brought into Parliament in the session of 1846, was opposed by Mr. Alexander Bain, who asserted in his petition that he had invented an electric clock, and an electric printing telegraph, and had communicated his inventions confidentially to Mr. Wheatstone, and that the latter had claimed them as his own. The Directors carried their Bill, notwithstanding this opposition, though not without difficulty, through the House of Commons; but Mr. Bain's statement and evidence made such an impression in the House of Lords, that, in the afternoon of the third day of the sitting of the

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Lords' Committee, the Duke of Beaufort, as Chairman, intimated to the Company's counsel that the Committee were of opinion that the Company ought to make an arrangement with Mr. Bain—hinting, in fact, pretty plainly, that their Bill might be thrown out if they declined to do so. After a consultation with counsel, it was considered necessary to give way. Mr. Bain was accordingly bought off, and became associated with the Company, to the extreme displeasure of Mr. Wheatstone.

About the same time, the Directors unluckily made an agreement with a Mr. Henry Mapple, in ignorance that this person had a similar controversy with Mr. Wheatstone respecting an improved alarum and a telegraphic rope. As a member of the Board, I know that it was the sincere desire of the Directors to retain the benefit of Mr. Wheatstone's scientific assistance, or at any rate to avoid doing anything which could be personally disagreeable to him; but in consequence of the untoward circumstances above referred to, he sent in an account of his expenses, and retired altogether from the Company's service.

I will assume that he had earned the £30,000 which he took away with him. But, *did he invent the Electric Telegraph?* The Award answers—No! and my forthcoming volume will show that the answer is not given on insufficient grounds.

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APPENDIX I.

Historical Account of the Introduction of the Galvanic and Electro-Magnetic Telegraph into England. By DR. HAMEL, *Member of the Imperial Academy of Sciences at St. Petersburg. Read before, and Reprinted by permission of, the Society of Arts. With Comments thereon, by* WILLIAM FOTHERGILL COOKE.—1859.

EXTRACT FROM THE "COMMENTS."

"Dr. Hamel gives the following well-ascertained dates:*—

1809. 8th July (p. 7.)—Soemmering invented his plan for telegraphing by evolution of gas.

1810. 13th August (p. 13.)—Showed it to Baron Schilling at Munich.

1802. May.—Grandominco Romagnosi discovered that the magnetic needle was deflected by galvanic currents, and in August in the same year published the discovery at Trent.—(P. 33.)

* "The earlier dates of the Telegraphic idea, by frictional electricity, go back to the middle of the last century; and are accurately traced in an article on the Electric Telegraph in the 'North British Review' (January, 1855), to a Scotchman in 1755."

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1812. 'Baron Schilling's operations with a sub-aqueous galvanic conducting cord, through the river Neva, at St. Petersburg.'—(P. 16.)

1815. 3rd August (p. 34.)—Baron Schilling communicated to Soemmering the 'Manuel du Galvanisme,' a book printed at Paris in 1805, mentioning Romagnosi's discovery.

"Baron Schilling may, therefore, be supposed to have known from this date the fact, that a galvanic current deflected a magnetic needle; although Dr. Hamel comes to the conclusion (p. 34), that neither Soemmering nor Schilling had any idea of a practical application of Romagnosi's discovery until 1825 or 1826, five years after Ampère's suggestion.

1820. Oersted directed the attention of the scientific world, more effectually than Romagnosi had done, to the influence of a voltaic current on a magnetic needle. Dr. Hamel supposes him to have been acquainted with Romagnosi's discovery of 1802.—(P. 35.)

1820. Ampère suggests 'that it might be possible to make use of the deviation of the needle for telegraphic purposes.'—(P. 40.)

1824. Scweigger invents the multiplier coil.

1830. April.—Is the first clear date given by Dr. Hamel in connection with Baron Schil-

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ling's needle telegraph, when it was shown to the Emperor Nicholas, 'who (he adds) had been pleased to notice it in its earlier stage.'—(P. 41.) But at p. 66, the Doctor speaks vaguely of 'above a dozen years previous' to 1837 as the date of Schilling's invention.

"In 1830, Baron Schilling had known for twenty years the details of Soemmering's telegraph; and for, at least, fifteen years, the deflective power of the galvanic current on the magnetic needle.

1835. Schilling shows his telegraph at Bonn, simplified to a single needle and multiplier.—(P. 43.)

1835. Müncke exhibits at Heidelberg a model of Schilling's telegraph.—(P. 43.)

1836. March.—Cooke sees Müncke's model of Schilling's one-needle telegraph.—(P. 49.)

1836. March.—Cooke makes two instruments (p. 53) shown in the Drawing, Part B, Vol. II., of Cooke's work, at the end, where they are compared with Müncke's models.

1836. March.—Cooke invents the mechanical telegraph and alarum, in which signals and sounds are given by the removal of the detent of clockwork by the voltaic magnet.—(P. 53.) Also the detector.

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1836. April 22nd.—Cooke returns to England to work out his scheme of realizing the old idea of an electric telegraph.—(P. 53.)

1837. January.—Negotiates with the Liverpool and Manchester Railway Company for the use of his 'so-called mechanical telegraph.'—(P. 53.)

1837. May.—The first electro-telegraphic patent applied for by Cooke and Wheatstone for their joint inventions.—(P. 55.)

1837. 'Baron Schilling ordered a submarine cable to be made to unite Cronstadt with the capital, through the Gulf of Finland, for telegraphic correspondence.'—(P. 69.)

1837. 25th July.—'A trial was made at the terminus of the London and Birmingham Railway, then constructing, one mile and a quarter in length, from Euston Square to Camden Town. This was the first instance of out-door telegraphing in England with a galvanic apparatus.' 'Mr. Cooke had been permitted, at the Euston Square terminus, in a large building (the carriage-house), to suspend many miles of wire, along which the current was made to pass, besides the wires in the open air to Camden Town.' —(P. 55.)

"These facts and dates together will, perhaps,

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indicate to what countries, and in what relative proportions the realization of the galvano-electric telegraph is really due.

"In Cooke's second volume, p. 119, the question of *invention* is thus viewed:—'If the electric telegraph were to be described generally in a few words, how would you describe it? Might it not be called an application of a few known principles, by means of a few simple contrivances to produce a practical result, which the experiments of scientific men, though their attention had been directed to the subject for a long series of years, had failed to produce?'.

"Thus Soemmering took up the *idea* of an electric telegraph, and experimented with the decomposition of water by the galvanic current. Schilling, after contemplating these contrivances for fifteen or twenty years, adopts Romagnosi's discovery, at Ampère's suggestion of the practicability of the magnetic needle telegraph; fortifies himself with Scweigger's multiplier of force; and invents a simple and striking instrument, which appears under various modifications in lecture-rooms and scientific journals, for six or seven years, at the end of which it dies out. The very sight of this instrument in operation instantaneously excites another mind to devote itself to the realization of the long-barren idea.

"To continue the foregoing quotation:—'The merit of the invention must, therefore, consist, in

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a very great degree at least, in the *practical realization* of that which had before been an idea or an experiment:'—and this practical realization belongs to ENGLAND."

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APPENDIX II.

EXTRACTS RESPECTING THE SUBMARINE TELEGRAPH.

"*Documents*," Vol. I., p. 249.

"1, Copthall Buildings, London,
3rd October, 1845.

"It is understood that Mr. Wheatstone will take the Chair of a Committee of three, to take charge of the manufacture of the patent telegraphic instruments, and the taking out and specifying future patents, and matters of the like nature, at a salary of £700 a year, and shall devote to such objects what time he shall think necessary. It is also understood that a patent shall be applied for immediately in order to secure Mr. Wheatstone's improvements in the mode of transmitting electricity across the water; that Mr. Wheatstone shall superintend the trial of his plans between Gosport and Portsmouth; and if these experiments prove successful, then in the practical application of the improvements to the purpose of establishing a telegraph between England and France; the terms on which such Telegraph is to be held being a matter for arrangement between the proprietors of the English and French Patents. These terms are understood as a part of Mr. Cooke's plans for disposing of the patents for the Electric Telegraph to a Company.

WILLM. F. COOKE.
C. WHEATSTONE."

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* * * * *

"'*These terms are understood as a part of Mr. Cooke's plans for disposing of the patents to a company.*' *These terms*—what terms?

Mr. Wheatstone's duties, viz.:—

1st. Taking charge of the manufacture of the patent telegraphic instruments.

2ndly. Taking out and specifying future patents, &c.

3rdly. *Applying for a patent immediately* '*to secure his improvements in the mode of transmitting electricity across the water.*'

4thly. Superintending the trial of his plans between Gosport and Portsmouth.

5thly. *If successful*, 'establishing a telegraph between England and France.'

* * * * *

"From October, 1845, to June, 1846, Mr. Wheatstone was on the best possible terms with the Company. He had full command of the Instrument Department. He had full scope for 'his operations' at Portsmouth: in fact, he was the whole 'Committee.'

"Thus the memorandum was 'for a time acted upon' by the Company and myself—but how was it acted upon by Mr. Wheatstone? He took no steps towards fulfilling the essential condition that a patent should be applied for immediately to secure

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his 'improvements in the mode of transmitting electricity across the water.' Except in his department, all was energy and activity. Mr. Ricardo was engaged in contriving the central station, organising the telegraphic system, and conducting our bill through Parliament. My attention was required far and wide over the country, in superintending a great extent of new works, and arranging agreements with railway boards. Our engineer was making every effort to complete the Admiralty line between the termini of the railway and the Admiralty Offices at Portsmouth and Whitehall; for in the meantime the payment of the rental was suspended. Nothing was wanting but the 'improvements in the mode of transmitting electricity across the water' at Portsmouth, to be used also for transmitting it under the streets in London. This want Professor Wheatstone was to have supplied. It was especially, indeed exclusively, in his department; and he had the 'resources of a powerful establishment at his command.' What was the Professor about? He says he was making 'an extensive series of experiments on methods of insulating conducting wires for the purpose of crossing the sea.'* But how does this agree with the memorandum that the 'patent (of course for something already invented on the 3rd October) was to be applied for *immediately?*' How does it agree with what follows?

* Wheatstone, p. 108.

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"As early as 1840, he tells us, in his 'Note on the Submarine Telegraph,'*

"Having been furnished with the necessary hydrographic information, - - - he prepared his detailed plans, which were exhibited and explained to a great number of visitors at King's College, among whom were the most eminent scientific men and public authorities.

"He also made the subject known in Brussels. In a notice of his new telegraphic instruments, by Prof. Quetelet, published in the 'Bulletin of the Academie Royale de Bruxelles' for October 7th, 1840, it is stated,—'On sera sans doute charmé d'apprendre que l'auteur a trouvé le moyen de transmettre les signaux entre l'Angleterre et la Belgique, malgré l'obstacle de la mer. Son voyage se rattachait en partie à cette importante opération, qui mettrait l'Angleterre en rapport immédiat avec notre pays, la France, la Hollande, l'Allemagne, et même la Russie.'

"And in 'Le Fanal,' a Brussels paper of September 30th, 1840, it is observed,—'M. Wheatstone pense qu'il est possible de communiquer avec son appareil entre Douvres et Calais; il répète en ce moment ses expériences à l'Observatoire de Bruxelles, en presence de plusieurs savans litterateurs.'

"Mr. Wheatstone's plans were also shown in 1841 to some of the most distinguished scientific men in Paris, who came to see his experiments at the College de France."

"The Abbé Moigno was in England in the spring of 1846, whilst Mr. Wheatstone's experiments were in preparation, and he published an account of what he had seen in 'L'Epoque' of October in that year. This notice he

* Wheatstone. Appendix, p. 130.

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afterwards reproduced in the first edition of his 'Traité de Télégraphie Electrique' (Paris, 1849). It is as follows:—

"M. Quételet avait annoncé, dès 1840, que M. Wheatstone avait trouvé le moyen de transmettre les signaux entre l'Angleterre et la France, malgré l'obstacle de la mer. J'ai vu de mes yeux, j'ai touché de mes mains le conducteur qui, en se reposant au fond des mers, unira étroitement les côtes d'Angleterre aux côtes de France. Ce conducteur est parfait, il remplira pleinement son but; tout homme sérieux qui l'aura vu et touché comme moi ne pourra pas même conserver l'ombre d'un doute sur un succès devenu palpable. Avant deux mois, des machines puissantes l'auraient produit dans toute sa longueur, mais partagé en section de deux kilomêtres et demi. Huit jours suffiraient aux officiers de marine, qui s'y sont préparé par une étude approfondie, pour le mettre en place, et après quelques semaines Paris et Londres se toucheraient; il n'y aurait plus ni abîme, ni distance, le génie de l'homme aurait tout vaincu."

"If Mr. Wheatstone had really done all this, why was not a patent 'applied for immediately,' or at least between October 3rd, 1845, and June, 1846, or down to the time when his experiments were given up the following autumn? And why did he waste time in preparing the specification, to be lodged six months after the date of the patent, instead of first taking measures to obtain the patent itself?

"If the various doings and expectations 'collected together and published' in his Appendix represented real things, I should have to complain of a breach of Mr. Wheatstone's engagements, under

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the deeds of 1837 and 1843, to make 'a full and open disclosure' to me of all his improvements, and to 'keep the same secret from all other persons.' But I acquit him of any breach of agreement, for it is sufficiently evident that he had not any invention to patent or to disclose. The fanfaronades in the Brussels papers, in the Paris report, and finally in Moigno's work,—like his first 'announcement in public print' in the 'Magazine of Popular Science' for 1837, were only *scientific landmarks*—'*publications ayant date certaine*'*—for Mr. Wheatstone to point back to when the Submarine Telegraph should have been realised by some practical inventor.

"In the meantime, the failure at Portsmouth left his submarine conception (with his Telephone†) 'in abeyance;'‡ till 'five years afterwards it was taken up from Mr. Wheatstone's starting-point,'—the wrong side of the harbour at Gosport. Sir John Guest's question,—paraded in his Appendix,—'Have you *tried* to pass the line through water?'§ might be answered by himself in the affirmative; but the next question, from Lord Seymour, 'Could

* Arago on Claims to Discoveries, *Supra*, p. 194, note.

† "I thought that I had the most efficient and economical means of establishing a - - - telephonic communication between two remote points, that could be thought of. - - - My ideas respecting establishing a communication of this kind between London and Edinburgh you will find in the 'Journal of the Royal Institution' for 1828." —*Wheatstone, Appendix*, p. 114.

‡ Wheatstone, p. 132.

§ *Ibid.*, p. 130.

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you communicate from Dover to Calais in that way?' had better be answered by those enterprising gentlemen to whom the world is indebted for the accomplishment of so great a work."*

* "When on the point of sending my last corrected proof to press, I gave a final glance over the pages of Mr. Wheatstone's Answer, to see that no point deserving of notice had been overlooked. Observing that Mr. Wheatstone quoted from the first instead of the second edition of Moigno's work, and suspecting some sufficient cause, I turned to the Abbé's second edition, and to my amusement, if not to my surprise, I found that the grandiloquent clauses extracted by Mr. Wheatstone in his 'Note on the Submarine Telegraph' had given place to the following passages (p. 259).

'M. Matteucci ..... indique ..... comment il comprend qu'on pourrait établir une communication télégraphique entre Calais et Douvres. M. Wheatstone avait eu avant lui cette idée.'.....

"And again at page 582,—'Comme nous l'avons vu, la pensée de cette entreprise grandiose appartient a M. Wheatstone, qui dès 1847 avait tout préparé pour la rèaliser.'

"The Professor has established his *scientific landmark* in the first edition, and the Abbé's attempt to dislodge it is vain—'*le génie de l'homme* (M. Wheatstone) *aurait tout vaincu.*'"

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THE ELECTRIC TELEGRAPH:

WAS IT INVENTED BY

PROFESSOR WHEATSTONE?

BY

WILLIAM FOTHERGILL COOKE, ESQ.

VOL. 1.—PAMPHLETS OF 1854-6.
VOL. 2.—ARBITRATION PAPERS.

LONDON:
SOLD BY W. H. SMITH AND SON, STRAND.
1857.

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APPENDIX III.

PREFACE TO PAMPHLETS AND ARBITRATION PAPERS. IN 2 VOLS. 1857.

THE first Part of this publication contains my recent and most reluctant appeal to the Public against Professor Wheatstone's perseveringly repeated misrepresentations; Mr. Wheatstone's Answer; and my Reply: the second Part contains a reprint of the proceedings in an earlier controversy between us; when the late Sir Isambard Brunel and Professor Daniell, having been called in as Arbitrators to adjust our relative claims to the Invention of the Electric Telegraph, awarded the questions in dispute in my favour.

The arbitration papers and drawings will be found, I hope, to contain matter of more permanent and general interest than the personal controversy which has called them forth. *Award*, p. 14.

My object, in this Preface, is to state, very shortly and in order of date, the leading facts established by the documents now published, with references to the documents themselves as my authorities.*

In 1823, Mr. Francis Ronalds, a gentleman well Mr. Ronalds'

* The *pages* referred to are those of Part I.: the *sections* referred to are those of the Arbitration Papers, reprinted in Part II.

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Publication, 1823.

known in the scientific world, published his "Descriptions of an Electric Telegraph, and of some other Electrical Apparatus;" a work of originality and merit, although as Mr. Ronalds proposed to work by frictional electricity, through a wire enclosed in a glass tube, his telegraph was not adapted for practical use.

Professor Wheatstone's Experiments on Sound and Electricity. 1823—1837. *Wheatstone's Answer*, p.114.

Possibly it might be Mr. Ronalds' publication which led to Mr. Wheatstone's experiments on the transmission of sound and electricity: for he fixes the year 1823 as the date at which his labours commenced. He says:—

"When I made, in 1823, my important discovery, that sounds of all kinds might be transmitted perfectly and powerfully through solid wires, and reproduced in distant places, I thought that I had the most efficient and economical means of establishing a telegraphic (or rather a telephonic) communication between two remote points that could be thought of. My ideas respecting establishing a communication of this kind between London and Edinburgh, you will find in the 'Journal of the Royal Institution' for 1828. Experiments on a larger scale, however, showed me that the velocity of sound was not sufficient to overcome the resistances and enable it to be transmitted efficiently through long lengths of wire. I then turned my attention to the employment of electricity as the communicating agent; the experiments of Ronalds and others had failed to produce any impression on the scientific world; this want of confidence resulted from the imperfect knowledge we possessed of the velocity and other properties of electricity; some philosophers made it a few

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miles per second, others considered it to be infinite; if the former were true, there would not be much room for hope; but if the velocity could be proved to be very great, there would be encouragement to proceed. I undertook the inquiry, and with the result the whole scientific world is acquainted. At the same time I ascertained that magnetic needles might be deflected, water decomposed, induction sparks produced, &c., through greater lengths of wire than had yet been experimented upon. In the following year, at the request of the Royal Society, I repeated these experiments with several miles of insulated wire, and the results were witnessed by the most eminent philosophers of Europe and America. I ascertained experimentally (which had never been done before) many of the conditions necessary for the production of the various magnetic, mechanical, and chemical effects in very long circuits; and I devised a variety of instruments by which telegraphic communication should be realised on these principles."

Mr. Wheatstone's lectures at King's College. June, 1836, pp. 52 & 152.

In June, 1836, Mr. Wheatstone "repeated his experiments" at "a course of lectures" at King's College; which were noticed nine months afterwards by the "Magazine of Popular Science," a monthly periodical, in its number for the month of March, 1837, published immediately after my first visit to Mr. Wheatstone.

Noticed by the Magazine of Popular Science for March, 1837, pp. 52 & 153.

The "apparatus" of which Mr. Wheatstone was in possession at the date of the above publication, is drawn and described in my Reply.

P. 155.

Origin of Mr. Cooke's Telegraph. March, 1836.

Just a year before Mr. Wheatstone's publication of March, 1837, having recently, on account of the

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state of my health, resigned my commission as an officer in the Indian army, I happened to witness, at Heidelberg, "one of those well-known experiments on electricity considered as a possible means of communicating intelligence, which had been tried and exhibited, from time to time, during many years, by various philosophers."

Award of Sir Isambard Brunel and Professor Daniell, p. 14.

"Struck with the vast importance of an instantaneous mode of communication to the railways then extending themselves over Great Britain, as well as to Government and general purposes, and impressed with a strong conviction that so great an object might be practically attained by means of electricity," I immediately directed my "attention to the adaptation of electricity to a practical system of telegraphing." Within three weeks I constructed a practical electric telegraph of the magnetic needle form; and soon afterwards several instruments of the mechanical form. The distinction between the two forms is explained in the Arbitration Papers, at section 29.

§ 29.

Commencement of the connexion between Mr. Cooke and Mr. Wheatstone. Feb., 1837. P. 15.

"In February, 1837," (to quote the Award again,) "while engaged in completing a set of instruments for an intended experimental application of his telegraph to a tunnel on the Liverpool and Manchester Railway, Mr. Cooke became acquainted, through the introduction of Dr. Roget, with Professor Wheatstone."

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I had applied to Dr. Faraday, and afterwards to Dr. Roget, for advice respecting the proportions of the electro-magnet used in my alarum and in my mechanical telegraphs. On the 27th February, 1837, I called on Mr. Wheatstone upon the same subject, and the circumstances of our earlier interviews are explained at p. 33. P. 33.

Application for First Patent. Partnership arrangements. May, 1837.

Two months afterwards we jointly applied for the first patent for an Electric Telegraph, immediately after a meeting at our solicitor's office, at which we arranged a memorandum of the terms of our partnership. At this meeting a long discussion took place; and Mr. Wheatstone fills two pages with his account of it. He expressly admits that I urged that my invention was more valuable than his; while he considered, he says, that, as we put ourselves on an equality, to allow his name which was known, to follow mine, which was unknown, might be construed into his admitting that my share of the invention was greatly superior to his. The memorandum is extant; and a copy of it will be found at page 151. It contains, in Mr. Wheatstone's hand-writing, and also in mine, the names of the "joint inventors" of the "Electro-magnetic Telegraph." Both in his hand-writing and in my own, my name takes precedence of his. P. 115. P. 151.

Patents taken out in the names of

The patents were accordingly taken out in the names of the "joint inventors," Messrs. Cooke

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Cooke and Wheatstone. 1837-8. § 711.

and Wheatstone; "in England in June, 1837; in Scotland in December, 1837; and in Ireland in April, 1838."

Partnership Deed. Nov., 1837.

In November, 1837, our partnership arrangements were completed, through the friendly mediation of Sir Benjamin Hawes; and my name, without objection or discussion, took the lead in the partnership deed, which "vested in Mr. Cooke, as the originator* of the undertaking, the exclusive management of the invention in Great Britain, Ireland, and the colonies, with the exclusive engineering department as between themselves, and all the benefits arising from the laying down of the lines and the manufacture of the instruments."

Award, p. 16.

Mr. Cooke's Letter to Mr. Wheatstone. Aug., 1838. P. 23.

I soon found that Mr. Wheatstone was silently appropriating to himself the whole credit of the invention; and as early as August, 1838, I addressed to him an earnest remonstrance on this subject. His promises to do me justice led to no result; and in 1840 the evil was aggravated by his invention of a beautiful and promising form of the mechanical telegraph, which he put forward at home and abroad as his sole invention, although

* When Mr. Wheatstone says that in one of my letters to him I made a claim "not indeed as original projector and leading inventor, for that I did not ask or desire," he unaccountably omits the end of the sentence—"*but as the inventor equally and jointly with yourself, standing, in point of merit, on precisely the same ground.*"

51.

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only "an improved reproduction of my own mechanical arrangements." § 95.

Placed in a questionable position in communications with railway authorities in England, and almost excluded from negotiation with continental governments, I felt myself now peremptorily called upon to vindicate without further delay my connexion with the invention. I wrote to Professor Wheatstone; and his answer will be found at page 113. Here, for the first time, he openly maintains P. 113. his ground, and vindicates to himself the sole invention of both forms of the Electric Telegraph.

Our differences were now referred to Sir Isambard Brunel and Professor Daniell. The Agreement of Arbitration, the statements of the parties, and the decision of the Arbitrators, are now before the public. Part II.

The Award gave me entire satisfaction, and Mr. Wheatstone subscribed a "cordial and grateful" acknowledgment of "the correctness of the facts stated" in it; but I soon found that he had con- P. 18. trived to explain it away. In May, 1843, I complained of this, through my solicitor, to his; and was silenced, if not satisfied, by a written assurance that "Mr. Wheatstone does not desire to escape from a single conclusion which the Award warrants." P. 40.

Two years afterwards, Mr. Wheatstone dropped

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P. 40. an incautious expression, disclosing the existence of a letter; which, in order to counteract the effect
Pp. 83 & 164. of the Award, or to provide himself with something which he could show instead of the Award, he had induced his friend Mr. Daniell to write to him. I remained in ignorance of the contents
P. 169. of this private award till last year; when Mr. Wheatstone found himself compelled to publish Mr. Daniell's letter in his answer to my pamphlet.

Mr. Wheatstone always showed an equal readiness to throw off his share of risk in times of difficulty, and to claim his utmost share of benefit when the difficulty had been overcome. He is now convicted, on his own confession, of a misrepresentation of our pecuniary arrangements. On this subject, it is enough to refer to the figures given
P. 232. by my Reply.

It may also suffice to refer to the introductory
Pp. 1—8. pages of my first pamphlet for an explanation of the circumstances which compelled me, after thirteen years' forbearance, to publish a correct statement of my transactions with Professor Wheatstone.

W. F. C.

OAKLANDS, STOCKBRIDGE.
May, 1857.

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APPENDIX IV.

EXTRACTS FROM VOL. I. OF "DOCUMENTS" (P. 213), EXPLANATORY OF THE PECUNIARY ARRANGEMENTS ON THE SALE OF THE PATENTS.

"At the beginning of the year 1843 we were at our lowest point of depression. The patents remained almost unproductive, and we had incurred, in various ways, a considerable outlay. I was still indeed hopeful, because a pamphlet,* which I had published at the beginning of 1842, had attracted the attention of engineers to the importance of the telegraph in connexion with a single line of rails. I had also just then introduced, under my patent of September, 1842, the cheap system of suspending the wires in the air, which has since followed the Electric Telegraph all over the world.

"But in the meantime further and increased outlay was indispensable. Having come to the conclusion that unless, with our own capital, we put up a specimen telegraph on the suspension plan, our disappointments might be endless, I had already obtained from the Great Western Railway Company the privilege of putting up and working for a term of years a telegraph to Windsor. It

* "Telegraphic Railways," by W. F. Cooke.

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had been proposed that Mr. Wheatstone should either find half the capital required for this Windsor telegraph, or cede to me as a 'separate privilege' the right of putting it up on my own account. This I was willing to do in aid of the common enterprise, though I had no capital conveniently at command, and could not hope for a remunerative return.

"Mr. Wheatstone's account was already, to some considerable amount, indebted to me. He declined (I do not say improperly, for it appeared that we had misunderstood each other on a collateral point) both my alternative propositions. What was to be done? To stand still was ruinous, and Mr. Wheatstone was not willing to move in the direction which seemed likely to open better prospects. Numerous meetings took place between us at the office of Mr. Wheatstone's solicitor. - - -

"In January, 1843, it was definitely proposed, at an interview at Mr. Richardson's office, that Mr. Wheatstone should assign to me his share in the patents for a fixed royalty. Before proceeding further, I caused Mr. Wilson to write a letter to Mr. Richardson, communicating without reserve all the information in my possession; suggesting causes which might add to the value then put upon the patents; and throwing upon Mr. Wheatstone and his solicitor the whole responsibility of fixing their own terms, upon their own judgment. The

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great importance of this letter justifies me in printing it entire, and in requesting attention to every part of it.

"1, Copthall Buildings, 13th January, 1843.

MY DEAR SIR,

With reference to the conversation of this afternoon, on the subject of the proposed arrangement between Mr. Cooke and Mr. Wheatstone, Mr. Cooke wishes, for obvious reasons, to protect himself from all responsibility, and to prevent the possibility of future misunderstanding, by repeating in writing what he has already expressed verbally, viz., that Mr. Wheatstone must form his calculations independently, and be guided by his own judgment and yours in fixing the mileage which he would be willing to accept. Mr. Cooke will state equally independently, what he would be disposed to bind himself to give, and if there is any difference of opinion, it must be discussed; but it must be clearly understood as the basis of the negotiation that Mr. Wheatstone is not to be guided by Mr. Cooke's opinion, but by his own.

Indeed, Mr. Cooke has already explained to you that he cannot give any opinion which would deserve to be depended upon. He thinks the value of the patents for the Electric Telegraph depends entirely on the capital and energy with which they can be worked out, and the cheapness with which the work can be executed.

Mr. Cooke proposes the following data for your consideration.

On the Blackwall line, the charge for the license was £100 per mile, for a distance of four miles or thereabouts.

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On the Edinburgh and Glasgow line, the charge was only £100 for a distance exceeding a mile.

On the Leeds and Manchester, the same sum was asked but refused, and nothing was in fact paid for the license on that line.

On the Yarmouth and Norwich line, an agreement was made for a license at about £110 a mile, to be taken in shares, in consideration of Mr. Cooke's becoming a considerable shareholder, and paying the deposit on his shares before the bill was applied for, which deposit would have been lost if the opposition to the bill had succeeded. The charge for the license was found to be a serious difficulty, and the agreement, in consequence, has not yet been confirmed by the Board of Directors, who will probably require considerable modifications of it.

On the Croydon line, a proposed charge of £70 per mile was considered too high, and broke off the arrangement.

Difficulties of the same kind occurred on the Great Western.

The only estimate yet made of the value of the English patents was made when * * * * (friends of Mr. Wheatstone's) proposed to purchase a share. Mr. Wheatstone then named, and Mr. Cooke approved £5,000 as the price of a quarter share: and it was afterwards arranged that the one-third share should be sold for £3,300 in cash and £3,300 out of the purchaser's share of the first proceeds. The purchasers were not required to produce any other capital; though their influence was considered of value. Upon this principle, if Mr. Wheatstone's half share were valued at £10,000, it would, after deducting Mr. Cooke's per centage for management, be worth £9,000. This, you will recollect, was for England only, exclusive of the Great Western Railway district. The Telegraph was then in high repute, and two years and a quarter of the patents

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have since elapsed; on the other hand, recent improvements have diminished the cost one-half, and the introduction of single lines may render a telegraph indispensable.

The subject of the conversation of this day was, as I understood, as follows. In consequence of Mr. Wheatstone having several times expressed, on recent occasions, a wish to withdraw from all active interference in the patent business, and to leave Mr. Cooke entirely unshackled in his management, it was proposed that the patents for England, Scotland, and Ireland should be absolutely assigned to Mr. Cooke, he paying to Mr. Wheatstone a fixed sum per mile for every mile of telegraph laid down in the three countries under the patents, undertaking all legal and other expenses without contribution from Mr. Wheatstone, and releasing Mr. Wheatstone from the considerable claims which he now has upon him; all future improvements being included in the arrangement; the line from Paddington to Windsor by Slough not being subject to mileage; and a license being granted to Mr. Wheatstone securing his separate privileges within distinct establishments. The mileage in Ireland to be one-third less than in England, as the parties are only proprietors of two-thirds of the Irish patents.

I think we generally concurred this afternoon in thinking that if £50 were taken as the average price of one license with another, Mr. Wheatstone's mileage could not be fixed higher than £15. For his share of the £50 being £22 10*s*., only £7 10*s*. would remain to cover his share of Mr. Cooke's risks, and to liquidate his present claims, and remunerate the monied partner, if one could be met with. That is to say, there would be in fact only £15 in the whole to meet these contingencies.

The question, then, for the consideration of all parties

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seems to be this. Whether £50 a mile be or not a fair average price for licenses in the three kingdoms? Mr. Cooke is clearly of opinion that the great diminution of the cost and difficulty of laying down the apparatus will require some considerable reduction, in most cases, in the price of the license. Even assuming that £100, or possibly above £100, might be obtained in some instances; there would be many other cases in which a very much smaller sum, or more probably an annuity terminable at any moment, would be all that could be hoped for. It is evident that in the case of a terminable annuity, Mr. Cooke might not even recover the £15 payable to Mr. Wheatstone.

It is obviously for the mutual interest of the parties that the mileage reserved to Mr. Wheatstone should not be so high as to interfere with the most extensive development of the invention; and certainly a high charge, whether greater or less than the sum specified, would interfere proportionably with its extension in the cases likely to be the most numerous, namely, those in which the payment will be made by annuity.

Should this arrangement be completed, Mr. Cooke's first object, after having finished the Windsor Telegraph, would be to get the Telegraph laid down on the Croydon or some other trunk line, even at prime cost, with the hope that it might be taken up and extended by the branches in a profitable manner. He openly declares that by a temporary sacrifice he hopes eventually to increase the value of the licenses, whilst he extends more widely the use of the invention. Should he be disappointed in his hopes, the risk will be his: to Mr. Wheatstone will be secured a moderate but safe return, which, under any circumstances, will probably be much greater, at all events for several years, than any profit which he can expect to derive from his share in the patents, under the present arrangement, and

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while the tastes and occupations of one of the present partners prevent his entering actively into the business.

Mr. Cooke and I will meet Mr. Wheatstone at your office on Monday, at twelve, as proposed, and I trust that this letter, by fully and openly explaining Mr. Cooke's sentiments, will facilitate our arriving at a definite understanding.

I remain, my dear Sir,
Yours very truly,

WILLIAM RICHARDSON, Esq. ROBT. WILSON.

P.S.—Mr. Cooke particularly requests that you will favour him by sending Mr. Wheatstone a copy of this letter, that he may weigh the points suggested for his consideration before the meeting on Monday."

"It was after this letter that a continued and protracted negotiation terminated in the new arrangement of 1843 - - -

"The business progressed exactly in the manner which had been anticipated. I laid down a telegraph to Slough, on which, as it was intended as an illustration of the new system of suspension, no royalty was made payable. I then proceeded, as proposed, to lay down a trunk line, selecting the line to Portsmouth in consequence of the opening presented by the arrangement with the Admiralty. This was effected partly, though by no means exclusively, through Mr. Wheatstone's influence; and in consequence of the assistance he had given me, I offered him an equal share with myself in the

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undertaking—an offer which he entertained, but of which he could not eventually avail himself. The works were executed by the railway company and myself in partnership, each finding half the capital for the telegraph; but the whole of Mr. Wheatstone's royalty, amounting to upwards of £1,500, was thrown as a separate burden on my share, and was paid to him by me. Subsequent experience has verified my expectation that the rates of license would fall, and would assume the form of annuities; and long ere this, if the agreement of 1843 had remained in force, the rates fixed by it would have become prohibitory unless revised under the last clause of the deed to which Mr. Wheatstone refers.* - - -

Mr. Wheatstone infers that my sale of the patents necessarily involved a contemporaneous purchase of his royalty, but so far from this having been the case, my proposals were always based on the supposition that the royalty would continue to be a charge on the patents in the hands of their new proprietors.

Thus, a statement which my solicitor drew up as early as 1843, to be handed to a gentleman with whom a negotiation was then pending, commences with a list of the patents; the licenses already granted; and the lines, finished, on hand, and in prospect; and concludes as follows:—

* Wheatstone, p. 42.

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"Mr. Wheatstone's royalty would be a charge upon the joint property. Its amount is as follows:—

For the first ten miles of Telegraph laid down every year	£20 per mile.
For the second ten miles	£19 per mile.
For the third ten miles	£18 per mile.
For the fourth ten miles	£17 per mile.
For the fifth ten miles	£16 per mile.
For each mile beyond fifty miles . .	£15 per mile.

Mr. Wheatstone has also a license for the use of the inventions for certain domestic and other purposes, limited to distances of half a mile as the extreme extent of his communications."

The speculative year 1845 gave rise to new negotiations for purchase of the patents, with a view to the formation of a company, but still subject to Mr. Wheatstone's royalty, which was exhibited in a schedule, similar to the above, brought down to the day; and it was by the request of the gentlemen who had proposed to join me, that I enquired whether Mr. Wheatstone would be disposed to sell, and on what terms.

Mr. Wheatstone has referred to a letter of mine of the 31st July, the result of a conversation on the previous day, when he had requested me to make a definite proposition in writing. I set out the letter below, and Mr. Wheatstone's reply. I certainly see nothing in this correspondence to justify his charge of "bargaining;"* but the

* Wheatstone, p. 44.

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reader can judge between us. I simply reported Mr. Wheatstone's terms to the promoters of the company, and left the option of purchase to their consideration: it being a matter of perfect indifference to me whether they purchased his royalty or not.

The correspondence was as follows:—

"Kidbrooke, near Blackheath,
July 31st, 1845.

MY DEAR SIR,

The proposition I made to you yesterday for the commutation of your royalty over a large portion of England and Wales may be comprised in the following question:—For what sum paid down now will you commute your royalty over the whole of England and Wales lying north of the Thames from its mouth to London, and north of the Great Western Railway from London to Bristol, but not including the railway itself, which will remain subject to your royalty? Say the cash to be paid half within three months, and the remainder within six months more?—I have also to ask you, as a distinct proposition, whether you will accept of the sum of £20,000 as a commutation of your royalty for England, Wales, Scotland and Belgium, and your share in the Irish patents—and also including the exclusive rights in Great Britain and Ireland, but not in Belgium;—£10,000 to be paid in four months from this date, and £10,000 six months later?

I am, yours faithfully,
WILLM. F. COOKE.

P.S.—The latter proposition to include all cash settlements pending between us at the present time. As you

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are, I believe, connected with others in the 'exclusive rights,' you can add £1,500 in addition to the £20,000 on that score.

CHARLES WHEATSTONE, Esq."

"20, Conduit Street, August 2, 1845.

MY DEAR SIR,

I have thought over your propositions, and after due consideration have arrived at the following conclusions. I will commute my royalty on *all* lines in England (and Wales) for the sum of £20,000, the royalty on lines completed before the payment of the first instalment of £10,000, to be paid to me under the present arrangement. The grounds of my calculation are these:—1st, that thirteen railway lines, averaging 100 miles each, would realize to me the above sum: 2ndly, that at the rate even at which lines have been completed during the first six months of the present year, the sum I have named would be realized in four, or at the utmost, five years: circumstances may augment or diminish this income, but I consider the chances of increase and decrease equal: 3rdly, that whatever arrangements be made for the sale of the Patents to other parties, the agreement with them cannot affect lines established previous to the date of such agreement.

If the Great Western Railway, and the portion of England south of this line and the Thames be excluded, I would fix the commutation at £16,000.

I will for a further sum of £10,000 give up all my rights in Scotland, Ireland, and Belgium, with all my reserved rights under the English Patents;* or I will

* To show how difficult it was to form any accurate estimate of the value of the Patents, I may mention that the whole of the

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make a separate arrangement for any one or more of these privileges.

I wrote, by last night's post, to M. Quetelet, to ask when he leaves Brussels, and when he returns; if it be possible to arrive there a few days before he leaves, I will start directly; but it will be of no use for me to be in Belgium when my most influential friend is absent.

Yours faithfully,

C. WHEATSTONE.

W. F. COOKE, Esq.

P.S.—These propositions to be of no effect unless agreed to within a month from the present date.

C. W."

"'Some further correspondence took place on points of detail, but the terms themselves were in all points of substance agreed to as at first proposed in Mr. Wheatstone's letter. He received the £30,000 which he asked, together with all arrears of royalty.'*

"Mr. Wheatstone alleges,† that 'he was not even treated with ordinary fairness, which is taken to imply open and candid dealing.' Here, at least, is a plain charge, made in plain language; and I will endeavour to be equally explicit in my answer to it.

"In the first place, is there any foundation in

amount paid for the Scotch and Irish Patents was a loss to the purchasers. The Belgian Patent, and the "reserved rights" have also been entirely unproductive.

* Cooke's Pamphlet, p. 45. † Wheatstone, p. 38.

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fact for his assertion* that he was kept in ignorance of 'the increased rate at which profits were accruing,' until 'he had parted with his royalties?'

"His words are:—

'Mr. Wheatstone - - - received in royalties on the operations of - - - 1845, £2,775; - - - but the account - - - was not rendered by Mr. Cooke till after the date of an agreement presently to be mentioned; and before, therefore, Mr. Wheatstone was fully cognizant of the increased rate at which profits were accruing, he had parted with his royalties on the terms vaguely described in Mr. Cook's pamphlet.'†

"The account, of which Mr. Wheatstone here professes to have been kept in ignorance, credits him, for eleven months of the year 1845, from the 1st January to the termination of the royalty arrangement on the 27th November, with £2,775, as the royalties on 175 miles.

"Mr. Wheatstone's letter of the 3rd August, fixing his terms, and printed above, states the grounds of his estimate of the value of his royalty in the following words:—

'The grounds of my calculation are these: 1st, that thirteen railway lines, averaging 100 miles each, would realize to me the above sum: 2ndly, that *at the rate even at which lines have been completed, during the first six months of the present year, the sum I have named would be realized in four, or, at the utmost, in five years:* cir-

* Wheatstone, p. 44. † *Ibid.*, p. 43.

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cumstances may augment or diminish this income, but I consider the chances of increase and decrease equal.'*

"Now as 1,300 miles in four or five years would give as the lowest yearly average 260 miles a year, while the business of 1845 only reached 175 miles for eleven months; it is evident from Mr. Wheatstone's own letter that he was *not* kept in ignorance of 'the rate at which profits were accruing,' although the account for 1845 (due at the end of that year) was not and could not be formally rendered till after the date at which he agreed to sell his prospective right to royalty.

"The manner in which Mr. Wheatstone may have become possessed of the grounds of his calculation appears by an incidental disclosure, in another letter to which he has referred, of the 'open and candid' nature of my communications to him.

"The negotiation which was in progress at the date of the former correspondence had gone off, but a new opening had presented itself for disposing of the patents.

"The new purchaser was not to be in London till November, and the option of purchase which Mr. Wheatstone had granted to me (the original period of which had already been extended) would expire on the 4th October.

"I had been fortunate enough to conclude an

* *Supra*, p. 94.

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arrangement for the Dover Railway, the most important and profitable telegraphic line in the kingdom. Did I simply ask Mr. Wheatstone whether it would be agreeable to him to allow me another month? Perhaps, as a man of business, I ought not to have said anything to disturb an arrangement already made: but, as during the negotiations of 1843, I went out of my way to communicate to him* every fact within my knowledge likely to influence his judgment, even to my own prejudice, so, in 1845, I began my application for further time by telling him, of my own accord, that I had secured the Dover line. The letter was as follows:—

'1, Copthall Buildings,
September 15th, 1845.

'MY DEAR SIR,

I have received an order for the Dover line, a circumstance very much in favour of the immediate formation of a Telegraphic Company. As I have not received your answer to a letter written last week, I conclude you are from home, and probably still on the Continent. I will therefore briefly repeat the substance. The arrangements I am making for the sale of the Patents are not sufficiently advanced to admit of their being completed by the 4th October, the day to which you limited me in your letter of (or about) the 4th August.

Before I commit myself so far, I require your consent to the extension of the period for which you have given me powers for the sale of your Royalty in England and Wales,

* By Mr. Wilson's letter to Mr. Richardson, *Supra*, p. 86.

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or in part. This period ought to be extended at least to the 15th November, when the commercial world will again be assembled in town, &c.

Yours truly,

PROF. WHEATSTONE. WILLM. F. COOKE.'

"The above letter, so strangely brought forward as evidence against me, proves that there *was* 'that explicit dealing on the part of Mr. Cooke, which Mr. Wheatstone's relations with him might have led him to anticipate.'* The same letter shows also that the intended formation of a company was mentioned to Mr. Wheatstone without reserve; and, I may add, without inconsistency between this mention of a company in a letter of my own and the mention of my 'new partner' or my 'friends' in letters from my solcitor.† I was forming an agreement of partnership with one capitalist, as the representative of himself and another, with a view to operations under a partnership deed until an act of parliament could be obtained to incorporate a company: Mr. Wheatstone's interest passing, *pro formâ*, through me to the partnership; and from the partnership, after the passing of the Act, to the Company. The mode of transfer was decided upon, and the deeds drawn, by the purchaser's counsel.

"In concluding this subject, I may observe that although I did not go out of my way to repose in

* Wheatstone, p. 47. † *Ibid.*, pp. 46, 47.

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Mr. Wheatstone a degree of confidence, which his conduct in the arbitration had necessarily forfeited, the arrangement I was making was in every step of its progress laid open to several honourable men of business experience and high standing; and the fact of my still enjoying their undiminished confidence and esteem, is a sufficient answer to any imputation from Professor Wheatstone.

"If then there was no concealment, and especially if (as I have shown) gratuitous information was afforded on points affecting the value of the royalties, Mr. Wheatstone would have no just cause of complaint, even if it were true that I had thought fit to ask for myself a higher proportionate price than that which he thought fit to ask for his separate interest. Let it be remembered that for two years our common interest had entirely ceased; that the patents were exclusively mine to deal with as I chose, subject only to a fixed royalty on the work annually executed. The long letter which preceded the arrangement of 1843, shows that it was Mr. Wheatstone's wish, not mine, which led to his retirement;* that he parted with his share of the patents upon the fullest information that I could give him; on terms fixed by himself and his solicitor; after a caution on my part that I disclaimed all responsibility for his decision, and an open avowal of my intention to make the patent

* Mr. Wilson's letter to Mr. Richardson, *Supra*, p. 88.

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property more valuable, if I could, by increased energy and outlay. I afterwards laid out, independently of other large expenses, at least £10,000 further capital, on telegraphs remunerative only in prospect. I paid to Mr. Wheatstone, out of my own private means, more than £1,500 royalty on the Portsmouth telegraph. It was my invention of the system of suspension, to which Mr. Wheatstone never laid any claim, and which reduced the expense of a telegraph something like 60 or 70 per cent., which at length crowned my labours with success. The active speculation in the year 1845, coinciding with the advantageous contract for the Dover line, and other opening prospects, raised the value of the patent property to an unexpected height. Now, if under these circumstances I had sold, ever so advantageously, the patent rights which by Mr. Wheatstone's request I had taken over, and my highly remunerative engineering department, why should Mr. Wheatstone have grudged me a well-merited and long-deferred reward for my perseverance and enterprise? I was not buying him out, in order to resell his rights at a profit. I was the owner of the patents, subject to a fixed encumbrance. I offered them for sale, subject to the burden, at a price mainly estimated on works in hand and in prospect; and it was the purchaser from me, not I myself, who offered to buy the royalty. I was not, as the Professor represents,

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an agent of his. I had no interest in the matter, except so far as the terms of purchase might affect, in some trifling degree, the value of the shares which I was afterwards obliged to take in the Company. I conclude, then, that I had a right to ask what I pleased as the price of what belonged to me, and that Mr. Wheatstone has no right to make comparisons between his price and mine, or to call upon me to enter into any explanation on the subject.

"But I have no objection to give the fullest explanation. The disproportion which I have assumed, for the sake of argument, had no real existence. Mr. Wheatstone was paid in a higher ratio for the prospective benefits of his royalty, than I was paid for the prospective benefits of the licenses, and of the extensive and lucrative contracting business, which my invention of the cheap mode of insulating the wires by suspension had enabled me to establish. In order to show this, I must first state certain private matters, which I would not unnecessarily have obtruded on public attention, viz., what the purchase-money amounted to, what deductions were made from it, and how the balance was paid.

"At the date of the sale I was actually out of pocket, on the operations of the ten preceding years, after crediting the account with all unused stores £14,908

Of this I received back as the purchase-

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money of my share in the Portsmouth and Great Western telegraphs		£10,000
Leaving a deficiency of . .		£4,908

"Of which upwards of £1,500 consisted of royalty paid to Mr. Wheatstone on the Portsmouth telegraph.

The price paid by the Company for the patent property was . . .		£150,000
Less a contingent amount which had been put down as the estimated value of a line for which I was then negotiating, but which was not obtained, and for which, therefore, the Company made me no payment .		£8,600
Leaving . .		£141,400
Of which Mr. Wheatstone asked and received . .	£30,000	
The Irish partner . . .	5,217	
Sundry other payments out of the purchase-money, the details of which are known to the Directors, including part purchase of a patent for the Company	10,117	
		45,334
Leaving for me		£96,066

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From which must be deducted my deficiency, as above, of £4,908

Leaving net £91,158

"The above gross amount of £96,066 was paid as follows:—

In cash	£2,566	
Out of profits when made, which payment was not completed for four years	48,000	
In 1820 £100 shares, the sale of which was, during several years, prohibited; and which, being paid up only to £25, were subject to further calls to the amount of £136,500, the whole of which has been since called up and paid	45,500*	
	£96,066	

In consideration of which payments, I was bound over to guarantee the Scotch and Irish patents, in certain events, to the amount of £6,666

And I bound myself to serve the Company gratuitously, which I did for several years.

* The first dividend paid on these shares was in 1851—about six years later.

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"It appears then that Mr. Wheatstone received in 1844 and 1845, in cash:—

Royalties of 1844	£444	
,, 1845	2,775	
Purchase-money	30,000	
		£33,219
Against my receipt in shares and future profits, subject to most serious liabilities, and to an obligation of gratuitous service, of		£91,158

"Taking the aggregate of these two sums, namely, £124,377, as the purchase-money of our united interests sold to the Company, I will first consider how this total should have been apportioned, under the original agreement of 1837,* between the good-will, capital, and exclusive engineering rights of the business on the one side, and the patents on the other, if the agreement of 1843 had not been made. Mr. Wheatstone correctly quotes my evidence when he states that my 'share of the patent rights had been less profitable than my employment as a contractor.' Let it even be assumed that the two were equal. The pur-

* I do not add to the £124,377 the £4,908, deducted, at page 102, from the gross purchase-money; because an outlay exceeding that amount was caused by the agreement of 1843; which agreement, on my present supposition, would not have been made.

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chase-money would then be divided into thirds; which would have given Mr. Wheatstone for half the patent, £41,459, paid as follows:—

One-third of 1820 shares, liable to calls as above, say . .	£15,000
One-third of the amount paid out of profits in four years . .	16,000
In cash	10,459
	£41,459
Less my 10 per cent. for management	4,146
Leaving for Mr. Wheatstone	£37,313

With a liability on the Scotch and Irish patents to the extent of £2,222.

"Thus £37,313 in cash and securities, subject to liabilities, would stand against the £33,219, which Mr. Wheatstone received in cash. Which would he have preferred if he had had to choose between the two?

My share—in amount nearly equal, and in the mode of payment greatly preferable, to what I really obtained—would have been as follows:—

Patent right	£41,459
Engineering business . . .	41,459
10 per cent. management . .	4,146
	£87,064

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To be paid:—	
In cash	£21,464
Out of profits	33,600
To be taken in shares . . .	32,000
	£87,064

"Secondly, I will assume, as the ground of an independent comparison, the letter to Mr. Wheatstone's solicitor,* on which, with unessential modifications,† the royalty arrangement was founded.

"This letter assumes an average price for licenses of £50 per mile, in the proportions of £15 for Mr. Wheatstone and £35 for myself.

"A simple rule-of-three sum will then give this result — As £15 : £35 :: £30,000 : £70,000.

£30,000 to Mr. Wheatstone, supposes a grant of licenses for about 2,000 miles, and consequently an equal extent of contract work: for the railway companies, at that time, invariably made it a condition that I should contract for the completion of the works and for their maintenance (on terms which proved highly beneficial) for six or twelve months.

* *Supra*, p. 88.

† It will be observed that the scale above £15 a mile only applies to fifty miles in each year, and could not have added to the year's royalties more than £150, beyond what they would have come to at a simple charge of £15 per mile throughout. *See the scale: Supra*, p. 43.

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2,000 miles, at £22 per mile, or 15 per cent., an amount below the average profit, would have yielded £44,000; which, together with patent right as above, should have yielded me £114,000; all in cash.

"I will add one more calculation founded on Mr. Wheatstone's statement,* that 'had Mr. Cooke - - - sold the patents, subject to Mr. Wheatstone's royalties - - - the latter would have acquired by the end of 1853 upwards of £70,000.' This is not a fair supposition, being founded on the results of the unfettered operations of a great Company. The supposition ought to be the attainment, under the agreement of 1843, of the same result without a sale: when our comparative profits would have stood thus:—

As £15 : £35 :: £70,000 :	£163,333
Being the result of about 4,600 miles, yielding at £22 per mile for contract	101,200
Or a total profit to me of	£264,533

"And this amount ought, according to Professor Wheatstone's views, to have been paid in cash, as well as his own £70,000. For says he:—

'It is to no purpose that he further excuses the disproportion by stating that the patents were his speculative property. Their value had been fairly tested; and if he chose to lay down certain lines, partly with his own

* Wheatstone, p. 49.

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capital, he did so safely and with the certainty of profit. If he confined himself, on the other hand, to his legitimate business as a contractor, it was in no sense more speculative than the royalties of Mr. Wheatstone. Both were speculative, in as far as the income arising from either might be indefinitely increased with the increase of operations. But the risk was none if Mr. Cooke confined himself to contracts at definite and remunerative prices, and there was no lack of these, or of a very ample '*margin*,' after payment of all the royalties due to Mr. Wheatstone.'*

"So that I ought to have received, from 1845 to 1853, £33,000 a-year in hard cash.

"I must dwell for a moment longer on this subject, even at the risk of tediousness; feeling sure that whatever other differences may unhappily exist between Mr. Wheatstone and myself, his remarks on these money transactions are founded entirely on misconception.

"I have shown that the net purchase-money was not nearly so large, even in nominal amount, as he supposes, and that the mode and conditions of payment were equivalent to a large further reduction.

"As regards my subsequent calculations, the reader may agree with them, or differ from them, in points of detail; but I wish to bring clearly and forcibly before him that he cannot differ from me on the question of principle involved. The fact must be recognised that, by the agreement of

* Wheatstone, p. 48.

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1837 between Mr. Wheatstone and myself, I had been established, in the most deliberate and solemn manner, as originator of the undertaking, in the exclusive possession of the engineering department, including 'all the benefits arising from the laying down of the lines and the manufacture of the instruments,'* and that out of the separate and exclusive rights thus secured to me, in my character of originator,—and by the entire devotion of ten of the best years of my life,—and by an outlay, to a considerable amount, and at no inconsiderable risk, of capital which I could ill afford to lose,—and by means, too, of my separate invention of the system of suspension, which was the main cause of my ultimate success,—I had gradually built up a most valuable and lucrative business.

"Whether, then, on the score of a legal right, conferred by one arbitration, and confirmed by another, and recorded in a partnership deed; or on the ground of what was fair, or on the ground of what is usual;—under any possible aspect of the case, I am entitled to consider my telegraphic business—exclusively mine by right, and not by sufferance—as having justly represented, as in estimates laid before the purchasers it really did, a large proportion of the money paid.† It is true, that 'it appeared, from the deed by which the patents were assigned, that they were the

* *Supra*, p. 11. † *Infra*, p. 98.

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sole consideration;' and legitimately, indeed necessarily so, because, as Mr. Wheatstone very properly adds, 'the value of his (my) business, as such, was derived principally from the possession of the patents.'* The patents, when assigned as a whole, included, in law and in fact, all the 'separate privileges' derived out of them in favour of either party; just as the freehold of an estate includes the right of cultivating it, or of building on it. But I fearlessly maintain that, looking at a large question largely, a man of business, acquainted with such matters, will find in the figures above stated a decided disproportion in Mr. Wheatstone's favour, and not any against him.

"Every one knows that it is usual, as it is also just and necessary, even in the most ordinary commercial undertaking, and much more therefore in the laborious and hazardous business of introducing a new invention into general use, to allow a large share of benefit to the man who gives up his time and risks his money. Mr. Wheatstone and I jointly acted on this principle when we gave up a half share in the American Patent; and afterwards, when we gave up a third share in the Irish Patents, to partners who, without giving time to the business, only paid the expenses of taking them out."

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* Wheatstone, p. 48.

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NOTE TO THIS APPENDIX.

Facts are better than arguments; and, at this distance of time, it cannot prejudice any interest to set out a copy of the actual proposition which led to the establishment of the Electric Telegraph Company.

"Sandgate, Sept. 30th, 1845.

DEAR SIR,

I enclose you the calculations and statements you requested. Having been on the road till a late hour, I have had no time to take any copy, for which I may wish hereafter to apply.

For obvious reasons, I must request that these papers may be considered strictly private and confidential, and only shown to those gentlemen who propose to enter into the undertaking.

I am, &c.,

W. F. COOKE.

J. LEWIS RICARDO, Esq."

(The papers enclosed in the above.)

1.—*Memorandum of profit upon various lines of Telegraph, already executed.*

Yarmouth and Norwich Railway (paid, in part, by shares *then* at discount), twenty miles, with six and seven wires—		
By 125 £20 shares, on which I paid £250 deposit	£2,225	
By cash, at £150 per mile	3,000	
		£5,225
By expenses, £112 per mile . .		2,240
Profit . .		£2,985
Tunbridge and Maidstone—Fifteen miles, with three wires, at £170	£2,550	
By expenses	1,395	
		1,155
Wolverton and Peterborough Telegraph: all expenses paid by the Company.		
Received for license		3,000
The Croydon, and other short lines completed this year, amount to about . . .		1,060
		£8,200

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The Telegraph from Nine Elms to Gosport and Southampton has cost about £9,700, or £104 per mile, for four wires, in ninety-three miles; being about £300 under my estimate.

This Telegraph has still to be extended to the Admiralty, Whitehall, and to the Admiral's house, Portsmouth, at an expense of about £2,000; to be borne equally by the patentees and the South-Western Railway Company.

The Government payment for two wires, and the necessary apparatus, is to be £1,500 per annum, for twenty-one years. The other two wires are the joint property of the patentee and the Company. They will be extended to the Strand, together with the Admiralty wires, and used for commercial purposes. All the above lines were furnished in less than fifteen months.

2.—*Estimated profit on lines now ordered:—*

London to Dover direct, eighty-eight miles; contracted for at £225 per mile, for four wires (arrangements for four more) .	£19,800	
Estimated expenses, the same as on the South-Western Railway, at £104 .	9,152	
		£10,648
The Company are also to pay, as license, £10 per mile for each wire fixed hereafter, during the continuance of patent.		
About seventy or seventy-five miles of branches—viz., Tunbridge Wells, Ashford to Canterbury, Ramsgate and Margate, also to Hastings, at £175 per mile . . .	12,250	
Estimated expenses for three wires, at £87 per mile	6,090	
		6,160
South Devon line—		
Fifty miles; four wires at £185 . .	9,250	
Estimated cost, £100 per mile . .	5,000	
		4,250
[This license reserves to me the right of making terms with Government for a Telegraph to Plymouth.]		
Carried forward .		£21,058

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Brought forward . .		£21,058
Grand Junction, Liverpool and Manchester; 113 miles, for four wires. £10 per mile additional for all wires beyond four.		
Price—£190	£21,470	
Estimated cost, £94 per mile . . .	10,622	
		10,848
On the Preston and Wyre Railway—		
The Company fix the work, paying me for wire, &c., and license	2,160	
Estimated cost	840	
		1,320
The Brighton Company have not yet ordered the Telegraph, though the terms are agreed on.		
Brighton Line, including branches to Hastings and Chichester, about 110 miles, at £175 per mile	19,250	
Estimated cost, at £87	9,570	
		9,680
The Sheffield and Manchester Company now have the adoption of the Telegraph under consideration.		
It is already fixed in their Woodhead Tunnel.		
The North-Midland, likewise, have one in their Clay Cross Tunnel.		
Profit on the two tunnels about		460
		43,366
Estimated value of my share of the Government and Commercial Telegraph between London, Gosport, and Southampton		12,000
		55,366

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Brought forward . .	£55,366
Estimated value of the Telegraph between Paddington and Slough, with my cottage and office . .	1,000
	£56,366

All the above interests I propose to bring into the common account; and, as a proof of my confidence in the correctness of my estimates, I am willing to retain them at the amount of £56,000.

WM. F. COOKE."

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Extract from "Award," page 14.

"Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking."

(Signed) "M^c I^D BRUNEL.
"J. F. DANIELL."

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